

Landfill Bioreactor Performance

Second Interim Report

Outer Loop Recycling & Disposal Facility

Louisville, Kentucky

Appendix A through Appendix F

National Risk Management Research Laboratory
Office of Research and Development
U.S. Environmental Protection Agency
Cincinnati, Ohio 45268

Appendix A

DATA VALIDATION REPORT



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MEMORANDUM

From: David Gratson

To: Thabet Tolaymat, EPA

Date: 24 July 2006

Subject: Data collection confirmation and chemistry data validation for the sampling period of Quarters 3 and 4, 2003, all of years 2004 and 2005.

Two tasks were performed under this task. The first task was to confirm that the data have been collected according to the specifications laid out in the Outer Loop Landfill Bioreactor Quality Assurance Project Plan (QAPP). The second task was to perform data validation on approximately 10% of the results that have been reported over the sampling period of Quarters 3 and 4, 2003, all of years 2004 and 2005. In general the project is proceeding as described in the QAPP. The only sampling that is not proceeding according to the original plan is for municipal solid wastes (MSWs). According to Waste Management Incorporated (WM), the reduced sampling effort has been communicated to the EPA TLP. A few quality control issues were noted in the data validation but no significant problems were identified in the second task. Ortho-phosphate results from batch A4B06994 should be qualified due to expired standards. Parameters that were measured in the field and captured in field notebooks were not validated. Also note that after requesting data from NCSU, they reviewed their spreadsheets prior to submitting them to me and found a few errors that were corrected. This indicates that the assessment process provided additional quality assurance in at least one case by encouraging additional data review at the researcher point.

1. Sampling Confirmation according to the QAPP (Revision 2, September 2003).

Sampling Schedule: sampling at each of the six landfill study areas (FLB 5N, FLB 5S, Control 7.3A, Control 7.3B, AALB 7.4A, AALB 7.4B)

Parameters (from QAPP, Tables 3-1 through 3-3):

Leachate:

Parameter	Monthly	Quarterly	Responsible Party
Chemical oxygen demand	X		STL-Buffalo
Biochemical oxygen demand	X		STL-Buffalo
Ammonia-nitrogen (NH3-N)	X		STL-Buffalo
Ortho P / Total P	X		STL-Buffalo
Nitrate-nitrogen (NO3-N)	X		STL-Buffalo
Nitrite-nitrogen (NO2-N)	X		STL-Buffalo
Volatile organic acids	X		Microbial Insights
Temperature	X		WM (field)
pH	X		WM (field)
VOC		X	STL- Buffalo
SVOC		X	STL-Buffalo
Total Kjeldahl Nitrogen		X	STL-Buffalo
Total dissolved solids		X	STL-Buffalo
Sulfate		X	STL-Buffalo
Chloride		X	STL-Buffalo
Potassium		X	STL-Buffalo
Conductance		X	STL-Buffalo
RCRA hazardous metals		X	STL-Buffalo

Municipal Solid Waste:

Parameter	Daily (250/yr)	Quarterly	Annually	Responsible Party
Oxidation reduction potential	X			WM
Temperature	X			WM
GPS (waste settling)		X		WM
Cellulose/Lignin			X	NCSU
Organic Solids			X	NCSU
Biochemical Methane Potential (BMP)			X	NCSU
Waste Moisture			X	NCSU
Waste Density			X	NCSU
pH			X	WM

Gas Sampling:

Parameter	Weekly	Quarterly	Responsible Party
Gas Production	X		
CH ₄ , CO ₂ , O ₂ (GEM 2000)	X		WM
NMOCs		X	STL
HAPs		X	STL
Summa Gases 3C		X	STL
Surface emission monitoring (SEM-500 for CH ₄) ¹		X	WM

1 Surface emission monitoring will be conducted twice quarterly.

Verification of sampling

Leachate:

Leachate sampling appears to be following the QAPP based on the laboratory reports received. Discussions with a WM representative Roger Green did not indicate any significant deviations.

Solid: samples were collected in 4th quarter 2003 (units 7.3 and 7.4) and 1st and 2nd quarters 2005 (units 7.3 & 7.4 and unit 5, respectively). No solids samples were collected in the 3rd quarters of 2003 or 2005. Roger indicated the solids sampling has not followed the annual schedule outlined in the QAPP for budgetary and as well as technical reasons. Since the solids sampling and analysis is the single most expensive task on the project and the first couple of solids datasets indicated annual sampling frequency was unnecessary, solids sampling is now performed less than annually. This has been discussed and understood between EPA and WM, but may not have ever made it into the QAPP.

Solids Sampling/Analysis Frequency Verified:

Collection Date	Parameters	Landfill Units	Source of Verification
11/2003	Cellulose, Lignin, Organic Solids, BMP, moisture.	All units	Excel spreadsheet "Outerloop Data Summary 03172006"
5/2004	Cellulose, Lignin, Organic Solids, BMP, moisture, pH	7.4 A & B	Excel spreadsheet "Outerloop Data Summary 03172006"
2/2005	Cellulose, Lignin, Organic Solids, BMP, moisture.	7.4 A & B, 7.3 A & B, 5.1 A & B, 5.2 A & B.	Excel spreadsheet "Outerloop Data Summary 03172006" and "OL2005 BMP Linked 042606 updated."
July 2001 – December 2005	GPS, Waste Settlement-Quarterly. 2003 has some missing for unit 5.	All units	Excel spreadsheets "U5 Bio settlement 4qtr05" and "U7 Bio settlement 4qtr05"

Gas:

Gas sampling appears to be following the QAPP based on the laboratory reports received. Discussions with Roger Green did not indicate any significant deviations.

Gases Sampling/Analysis Frequency Verified:

Collection/Analysis Dates	Parameters	Landfill Units	Source of Verification
Approx. Weekly from 7/10/2003 to 3/31/2005	CH4, CO2, O2 (GEM 2000), Gas Production, temperature	5.1 and 5.2	Spreadsheet "51G01 52G01 03312005"
Approx. Weekly from 4/17/2003 to 3/31/2005	CH4, CO2, O2 (GEM 2000), Gas Production, temperature	7.4 and 7.3	Spreadsheets "73A&B G01&2" and "74AG01 74B G02 03312005"
Quarterly	NMOC	All	Communications with Roger Green
Quarterly	HAPS	All	Communications with Roger Green
Quarterly	Summa Gases	All	Communications with Roger Green

2. Chemistry Data Validation.

Data validation consisted of reviewing the data according to US EPA Contract Laboratory Program, National Functional Guidelines (<http://www.epa.gov/superfund/programs/clp/guidance.htm>) where applicable (e.g. fixed laboratory). Full data validation to the raw data level was performed when this data

was available. Reports for the MSW solid matrix were in an electronic spreadsheets format. The spreadsheets were randomly checked for accuracy of calculations as well as completeness

Approximately 10% of the data collected over the periods from June 2003 through December 2005 was reviewed. The data packages and spreadsheets that were chosen for review as well as the time period to which they corresponded are provided below.

Laboratory/Sampler	Parameter	Year	Quarter	Corresponding laboratory report or data file
STL- Buffalo	VOCs	2004	3rd	Job #A04-8795, SDG 0904QB
	SVOCs	2004	4th	Job #A04-C260, SDG 1204QB
	Wet Chemistry includes COD & BOD	2004	1st	Job #A04-2205, 2437.
	Metals	2003	3rd	Job #A03-9269/A03-9459, SDG 1003Q4
	Anions	2005	1st	Job #A05-0235, A05-0484, A05-0836.
Microbial Insights	Volatile Organic Acids	2004	2nd	Job #A04-5133/A04-5828, SDG 0504MB
WM	GEM 2000: methane, CO ₂ , O ₂	2004	1st	Spreadsheets “73A&B G01&2”, “51G01 52G01 03312005” and “74AG01 74B G02 03312005”
	Surface emission: SEM-500	2004	4th	Not reviewed, field notes only.
	Leachate Field measurements: pH, temp.	2004	3rd	Not reviewed, field notes only.
	MSW Field: temp, ORP, pH	2004	3rd	Not reviewed, field notes only.
	GPS, settling	2005	4th	“U5 Bio settlement 4qtr05” and “U7 Bio settlement 4qtr05”
STL	NMOCs	2005	4th	Laboratory Report, File E6A030194.pdf
	HAPs	2005	3rd	Laboratory Report, File E5I290174.pdf
	Summa Gases 3C	2003	3rd	Laboratory Report, File E3I300199.pdf
NCSU	Cellulose: lignin	2005	3rd	Excel spreadsheet “Outerloop Data Summary 03172006” and “Lignin OL”.
	Organic Solids	2003	4th	Excel spreadsheet “Outerloop Data Summary 03172006” and
	BMP	2005	2nd	Excel spreadsheet “Outerloop Data Summary 03172006” and “OL2005 BMP Linked 042606 updated”
	Moisture	2005	2nd	Excel spreadsheet “Outerloop Data Summary 03172006” and “Moistures OL”

Results:

Leachate:

VOC Analysis: File A04-8795, Sampling Date: 9/14/2004 (from the COC), Date Analyzed: (from 8260 report) 9/17/2004. Cooler temperature, holding times, LCS/LCSD recoveries, and blanks met the method criteria. No surrogates, internal standards, MS/MSD information provided with this data package. No QA/QC non-conformances identified. Holding times check for all.

SVOC Analysis: File A04-C260, Sampling Date: 12/8-9/2005. Cooler temperatures met the required temperatures and the holding times were met for these samples. The MS recoveries for 4-nitrophenol and N-nitroso-di-n-propylamine in sample 74A L01 and pyrene in the MSD did not meet the recovery limits. These compounds met the recovery limits in the LCS. The MS/MSD precision (RPD) exceeded the limits for 2,4-dinitrotoluene, acenaphthene, and pyrene. The surrogate recovery for Terphenyl-d14 was below the limits for samples 73A L01 and 73B L01. CLP guidelines allow one surrogate recovery outside the limits with no corrective action necessary. None of the data from the samples was flagged. No significant QA/QC non-conformances identified that would affect these samples.

Wet Chemistry:

Anions (Nitrate, Nitrite, Ortho-phosphate): File A05-0235, Sampling Date: 1/10 and 1/18 2005. Cooler temperatures met the required temperatures and the holding times were met for these samples. The MS met requirements for ortho-phosphate and nitrite, the nitrate recovery was 75% in sample (A5048903), this is slightly below the lower limit of 77%. Nitrate was found at a concentration of 0.026 mg/L in the method blank. The LCS recovery met the method requirements for all three analytes. Ortho-P: Both the ICV and CCV standards expired (2/5/2004) approximately 40 days prior to analysis date (3/17/2004). Standards have a 6 month period from preparation to expiration. Therefore, the accuracy of the ortho-phosphate data is somewhat in question. The ortho-phosphate data (batch A4B06994) from this report should be qualified as estimated and potentially biased due to expired standards.

TDS, TKN, TOC, COD, BOD: All meet QC except BOD missed holding times for three samples due to depletion of oxygen in original analyses. This is a common problem with BOD due to the difficult matrix, short holding time, and varying concentration.

Metals/Elements (Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Potassium, Selenium, Silver): File A03-9269. Sampling Date: 9/25/2003. Cooler temperatures met the required limit and the holding times were met for these samples. No deviations from the method were noted in the case narrative. None of the data from the samples was flagged. No QA/QC non-conformances identified.

Organic Acids (Microbial Insights): File A04-5133, Sample Date 5/28/2004. Cooler temperatures met the required limit as received at STL and "Good, cold, intact" at Microbial Insights. Sample 51B L01 not received but was listed on the Chain of Custody (CoC) at STL. MS/MSD and LCS were within $100\pm20\%$ recovery and the RPDs were <15% difference.

Conductivity, Temperature, pH (Field): Not reviewed, this information is only captured in the field logbooks.

Gases:

NMOC: File: E6A030194, Sample Date 12/30/2005, Analysis Date: Jan 4 2006. Canisters meeting vacuum requirements prior to use. Holding time, blanks, replicates and LCS/LCSD all met method criteria. The initial calibration did not meet the criteria of 2.5%D from the mean response factor. The %D was greater than 2.5% but less than 5%. No other QA/QC non-

conformances identified. The deviation in the initial calibration reduces the overall accuracy slightly.

HAPs: File E5I290174, Sample Date 9/26/2005 per CoC. Analysis Date: 10/8/2005 – 10/11 2005 from data report. Canisters cleaned and met vacuum requirements, no sample numbers on canisters in the prep logs, blanks and LCS/LCSD met method criteria. Missing sample numbers in prep logs appears to have been clarified prior to reporting.

Summa Gases, Method 3C: File E3I300199. The canister for sample 73AG02 (E3/300199-6) contained no sample upon receipt at the laboratory. A new canister was provided and resampled later. Sample Date: 9/26/2003 (from Chain of Custody), Analysis Date: 10/6, 7, and 9/2006. Method 3C has no specified holding time. Blanks and LCS/LCSD results met method criteria.

Solids/MSW:

Cellulose/Lignin: Dates are 05/02/2005 to 02/13/2006, called “Set #6.” Checked % lignin calculation on all worksheets, blank results, reviewed for significant figures and general reasonable of numbers.

Organic (Volatile) Solids: Dates run from 05/09/2005 to 10/31/2005. Checked % Vol Solid, average and % rsd on approximately 30% of the worksheets, blanks reviewed. Criterion for %RSD is $\pm 25\%$. None identified that did not meet the %RSD criterion.

Moisture: Two sets (of #6) in spreadsheet, samples 05-2 to 05-210, dates of starting test run from 3/2005 to 6/2005. The checks included calculations, % difference, and completeness. Some of the starting dates are missing in Set 1.

Biochemical Methane Potential: File “OL2005 BMP Linked 042606 updated.” This file contains calibration and methane production numbers since 6/24/2005. Reviewed the calibration curves, data checking (JC), blanks, CV for triplicate analysis of samples for methane. Table 8 has criteria for BMP: $\pm 20\%$ RPD for triplicate analyses, re-analysis, then flag data if not met. CV checking indicates those $>20\%$ were re-analyzed. Concentration of blanks varies in several cases. Most methane curves show the standard above curve at the middle level (25). Note samples 156, 157 were rerun in 110705 worksheet.

Sugars: Data from file Sugars OL.xls, data from 04052005 to 02142006. These are done weekly analyses until September 2005, then monthly. Reviewed blanks and standards for Fucose, Arabinose, Galactose, Glucose, Xylose, and Mannose. Checked that correct row/column used in calculations for 2 worksheets.

Appendix B

SUPPLEMENTAL SOLIDS ANALYSIS FIGURES

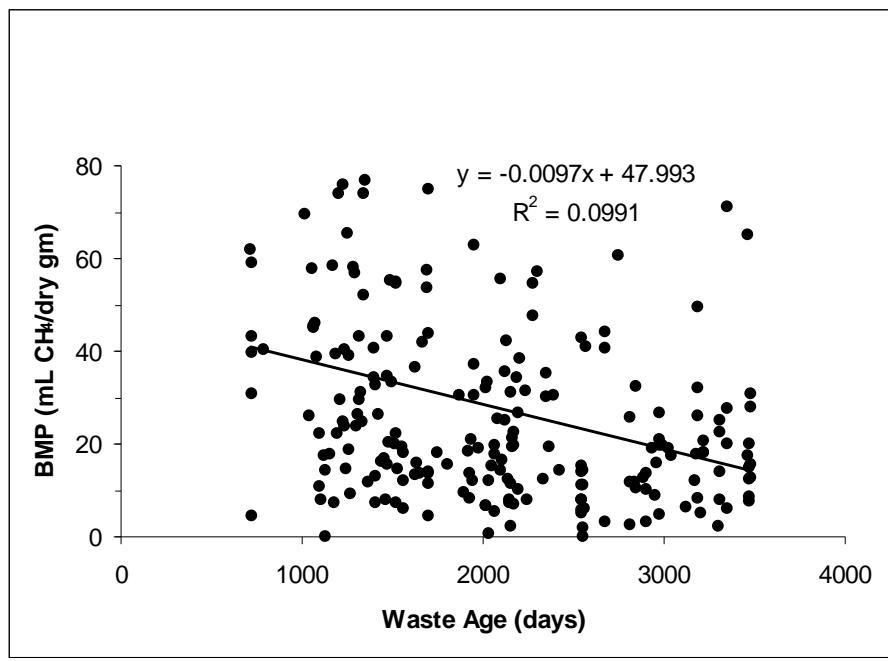


Figure B-1 Relationship between BMP and Waste Age in the Retrofit cell

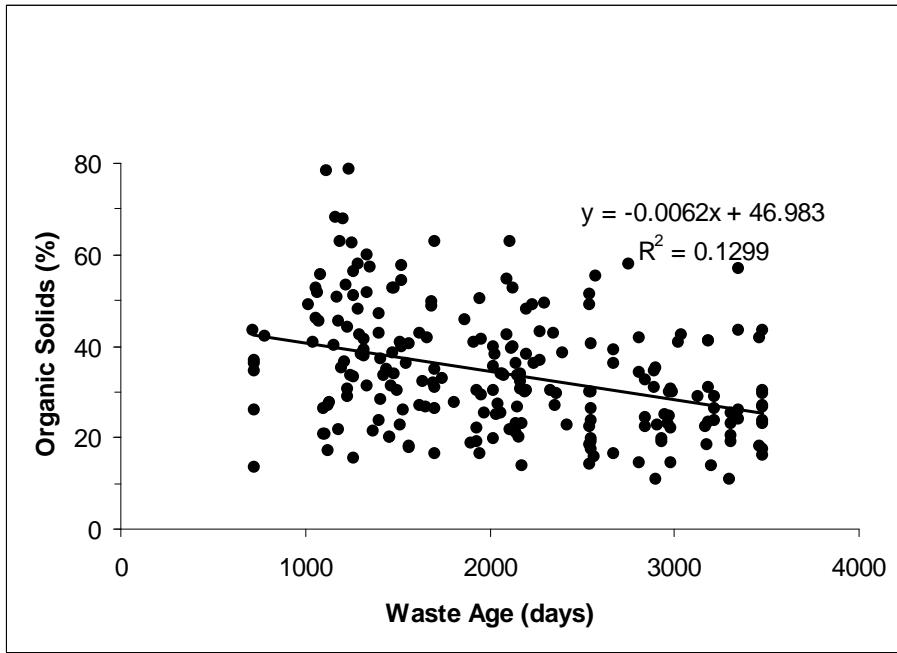


Figure B-2 Relationship between Organic Solids and Waste Age in the Retrofit cell

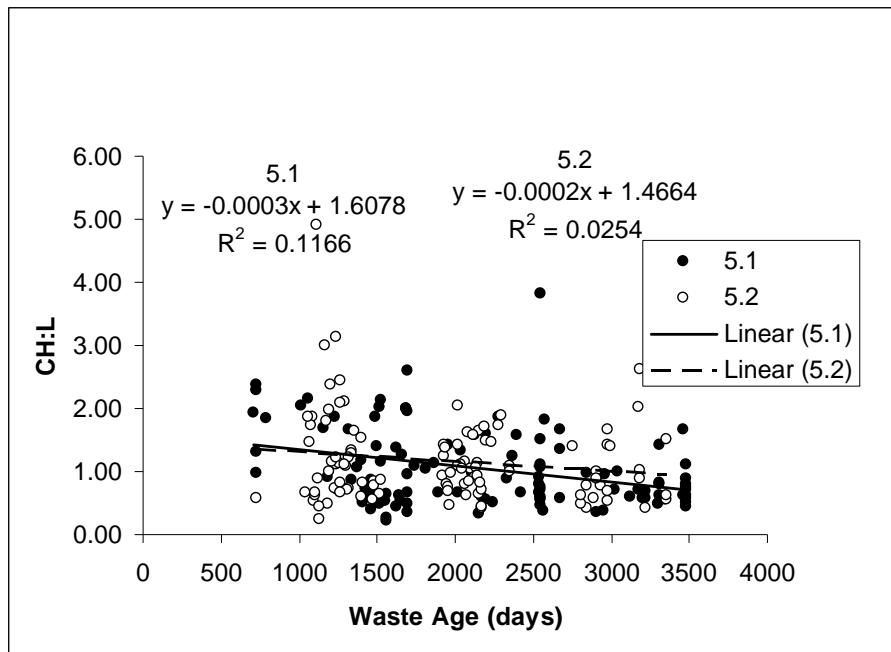


Figure B-3 Relationship between CH:L and Waste Age for the Retrofit cell When Separated by Area

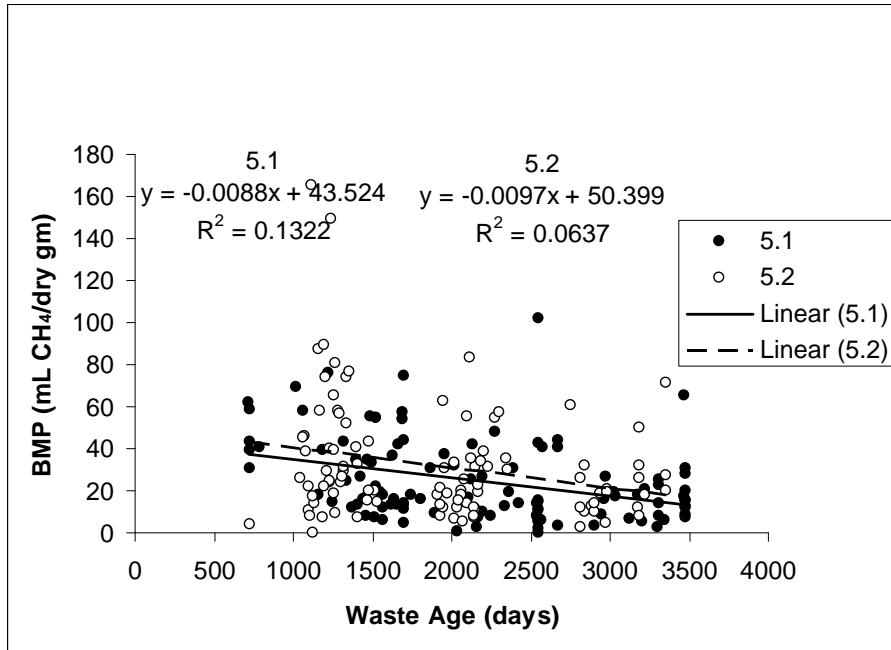


Figure B-4 Relationship between BMP and Waste Age for the Retrofit cell When Separated by Area

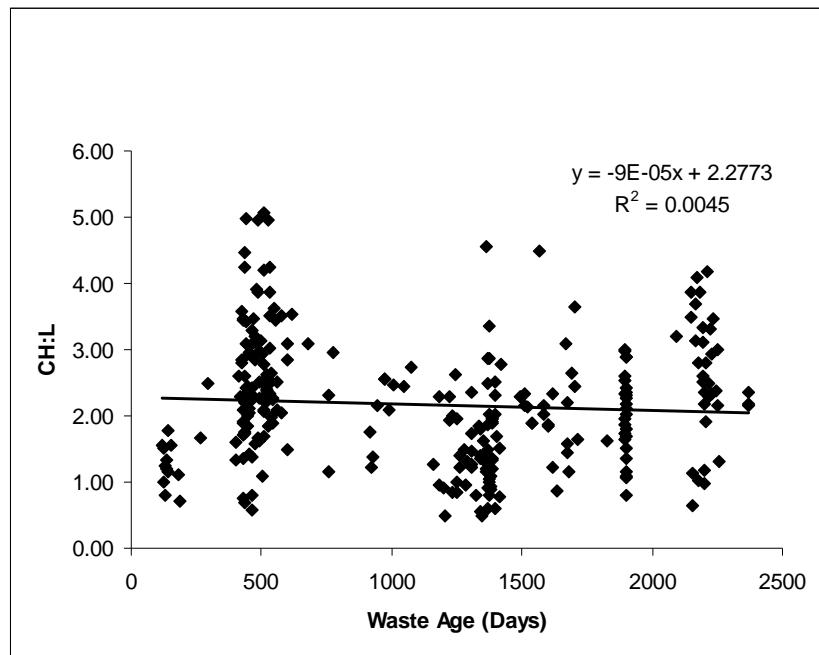


Figure B-5 Relationship Between CH:L and Waste Age in the Control cell

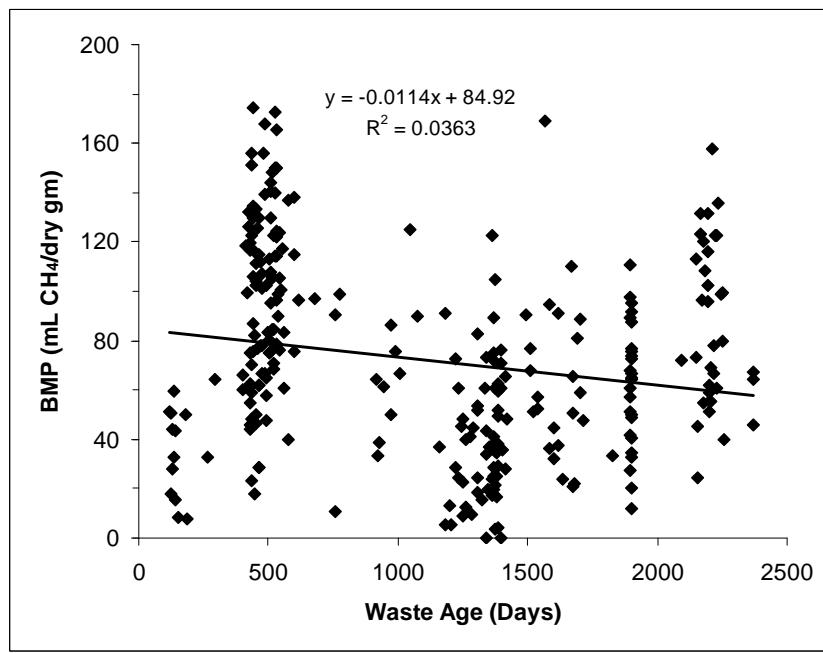


Figure B-6 Relationship Between BMP and Waste Age for the Control cell

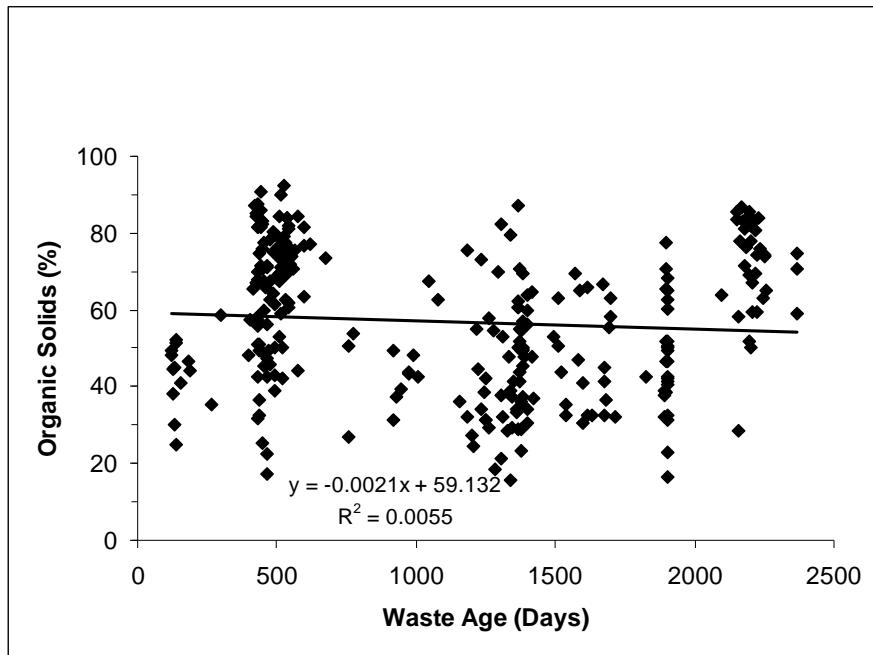


Figure B-7 Relationship Between Organic Solids and Waste Age in the Control cell

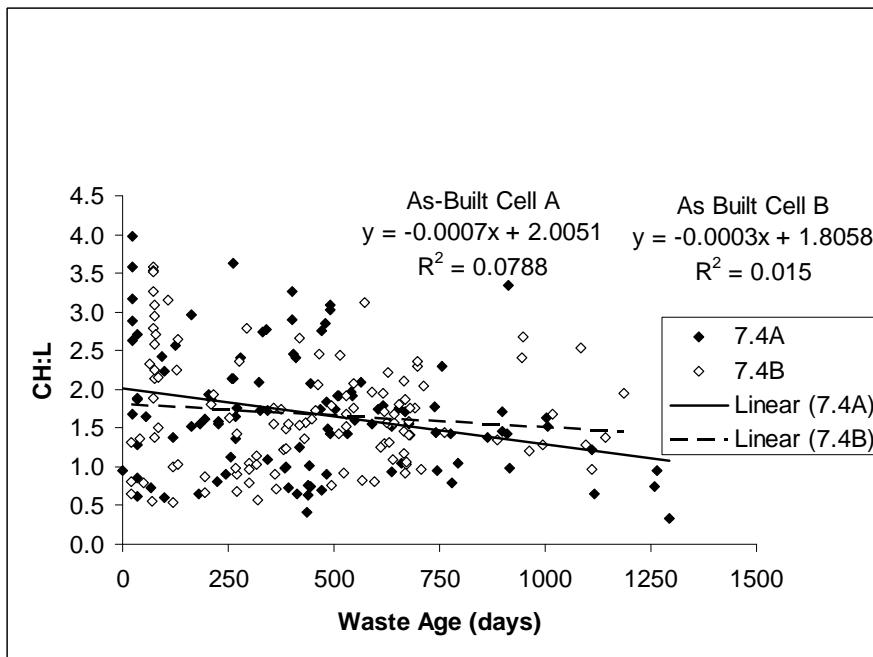


Figure B-8 Relationship between CH:L and Waste Age in As-Built cells 7.4A and 7.4B

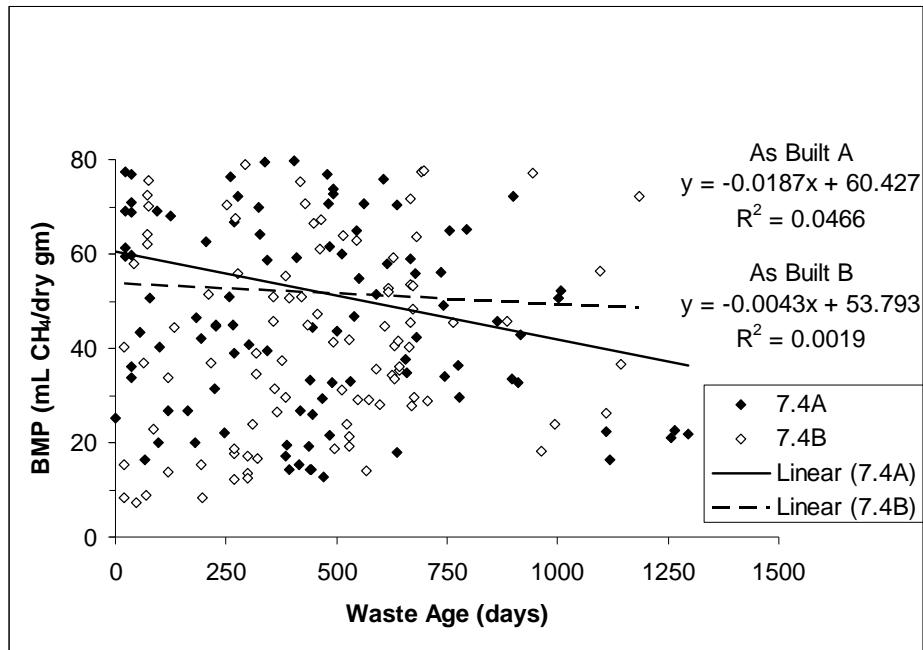


Figure B-9 Relationship between BMP and Waste Age in As-Built cells A and B

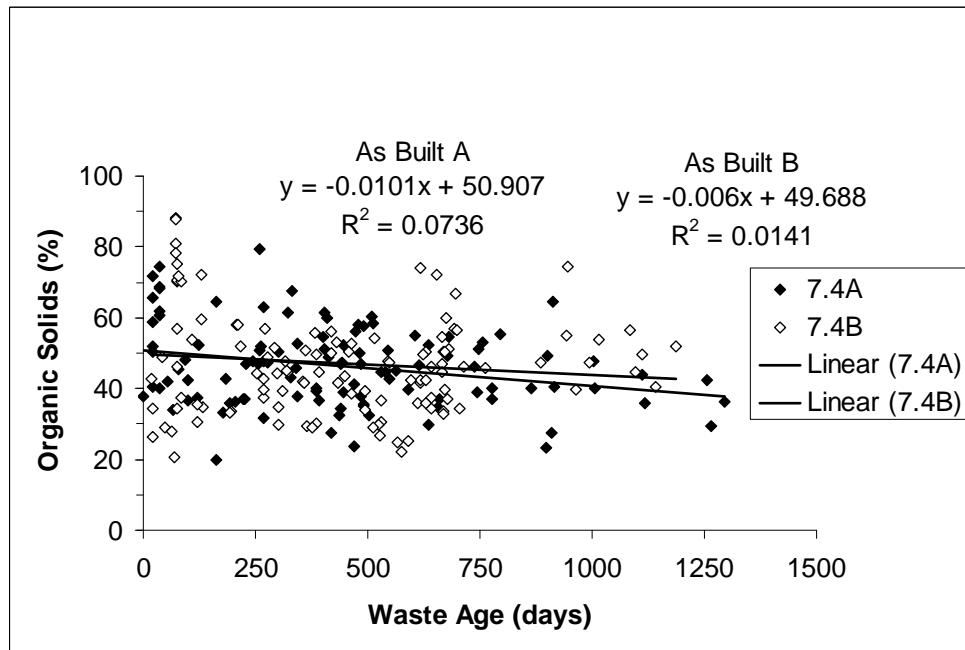


Figure B-10 Relationship between Organic Solids and Waste Age in As-Built cells A and B

Appendix C

MEASURED WASTE MOISTURE CONTENT

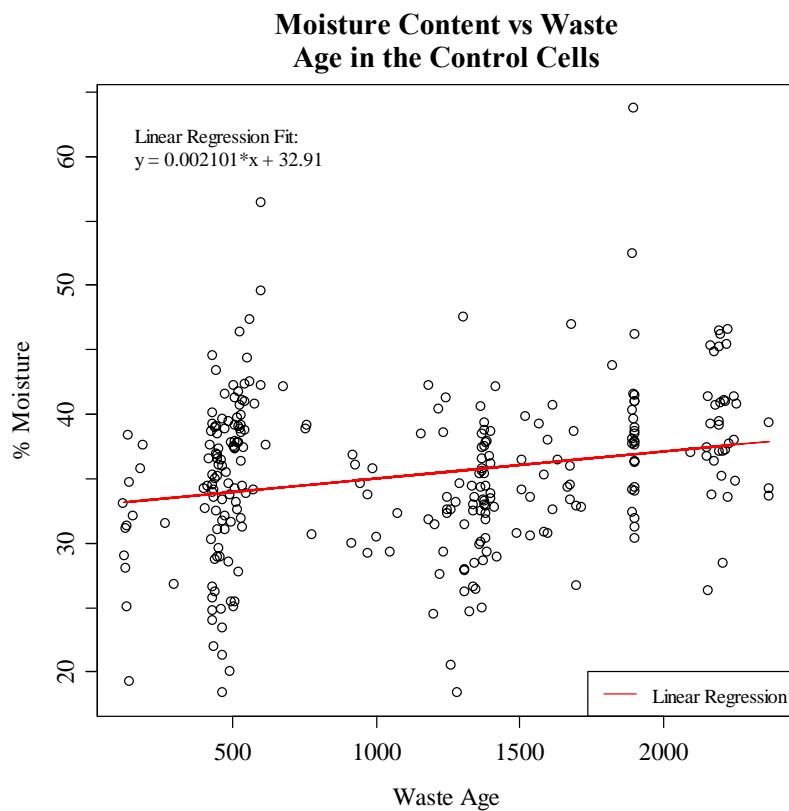
STATISTICAL ANALYSIS

Measured Moisture Content versus Waste Age

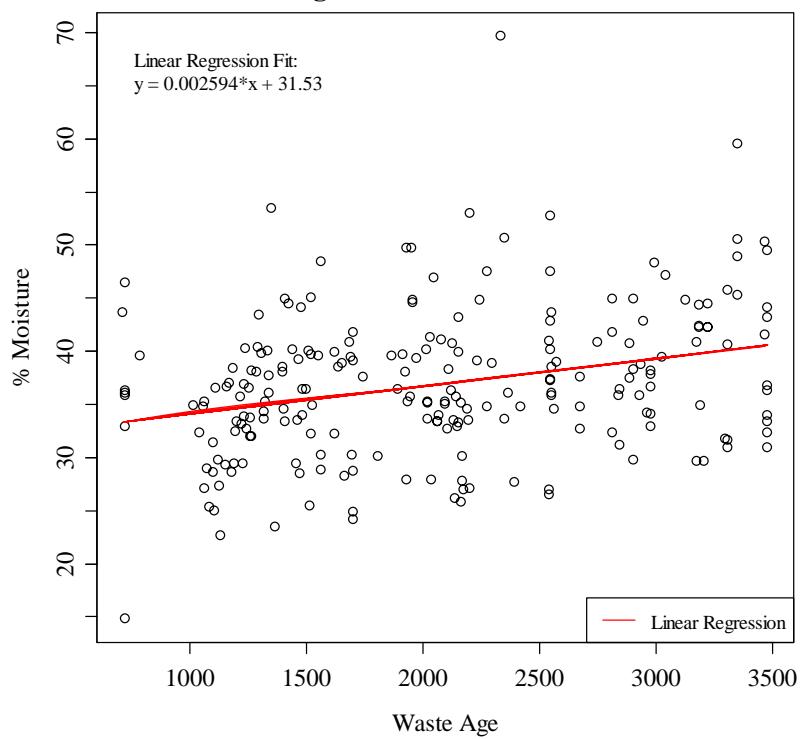
Linear Regression Fit

Cell	Intercept		Waste Age		Adjusted-R ²
	Coefficient Estimate	p-value	Coefficient Estimate	p-value	
Control cells	32.91	0.0000	0.00210	0.0001	0.0482
Retrofit cells	31.53	0.0000	0.00259	0.0000	0.0795
As-Built cell A	37.92	0.0000	0.00606	0.0373	0.0344
As-Built cell B	39.07	0.0000	0.01128	0.0138	0.0461

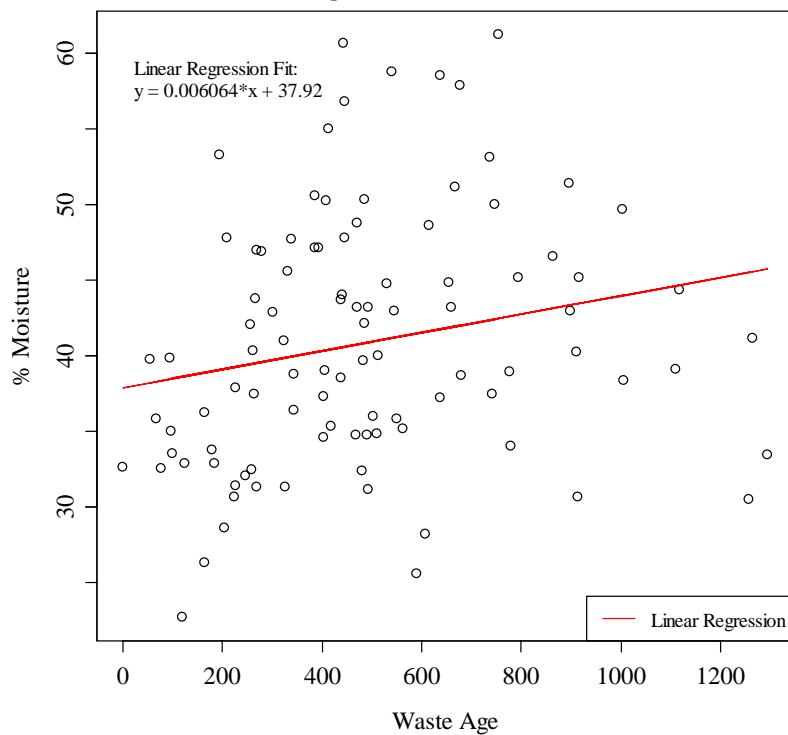
Timeplots

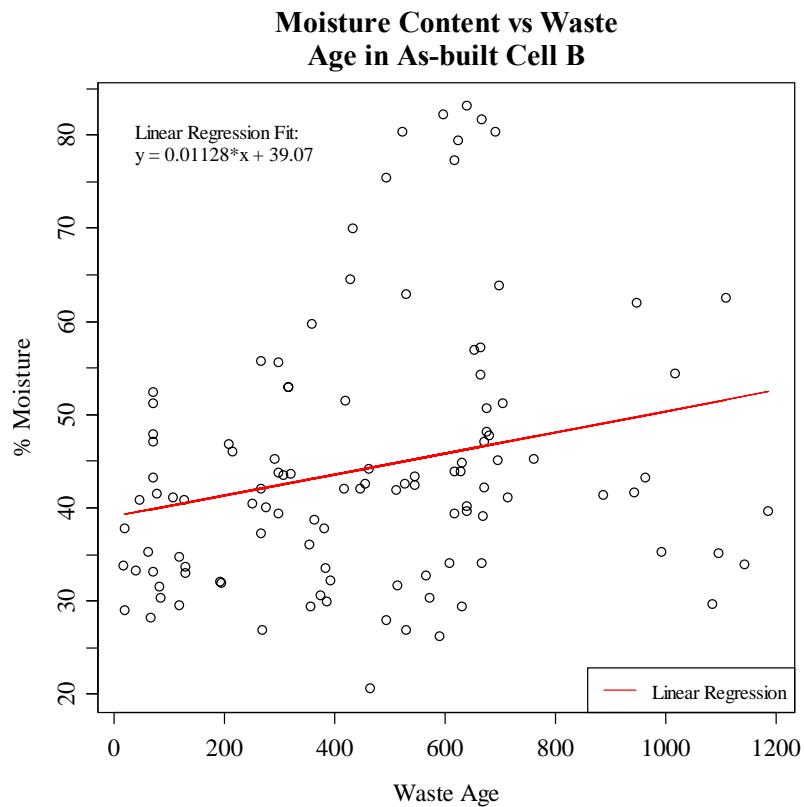


Moisture Content vs Waste Age in the Retrofit Cells



Moisture Content vs Waste Age in As-built Cell A





Measured Moisture Content versus Sampling Date

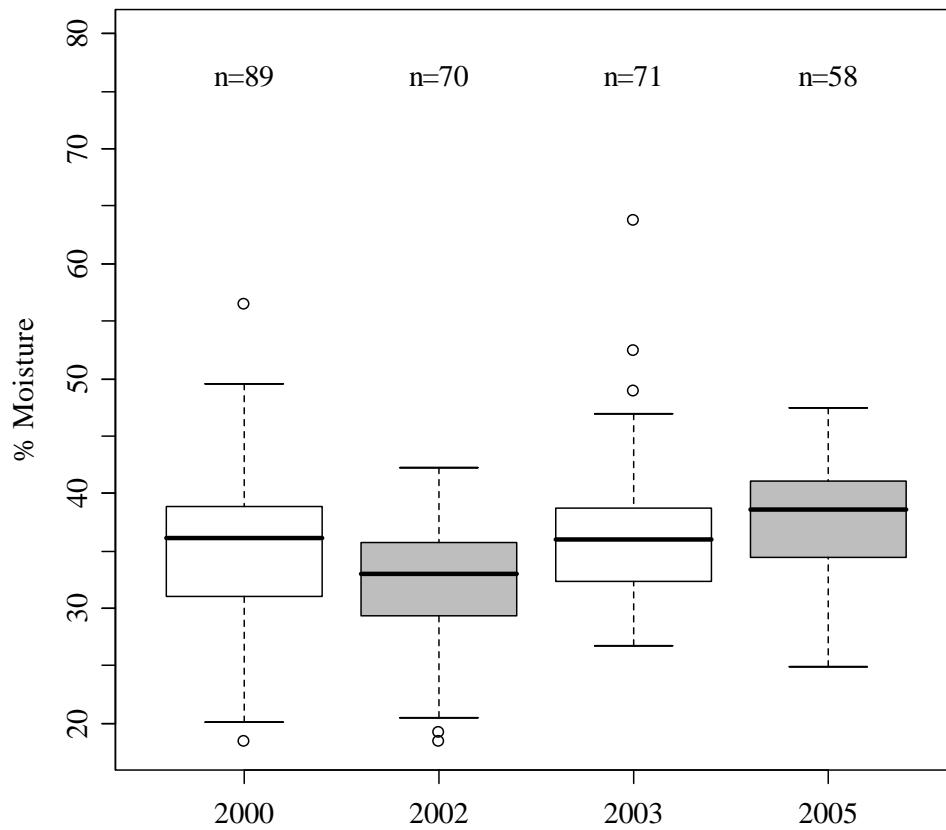
ANOVA Summary Tables and Boxplots for the Control cells

The *F*-test p-value indicates that at least two mean moisture content levels are significantly different. The Tukey multiple comparisons indicate that mean moisture content levels are relatively constant across sampling dates except for the drop in 2002. In addition, the boxplots don't provide evidence of a trend. Therefore, there is no evidence of a trend in mean moisture content with sampling date.

F-test p-value	0.0000
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Years	Estimated Difference	Lower Bound of CI	Upper Bound of CI	Adjusted p-value
2002-2000	-2.36	-4.78	0.06	0.0588
2003-2000	1.46	-0.95	3.87	0.4012
2005-2000	3.13	0.58	5.69	0.0092
2003-2002	3.82	1.27	6.37	0.0008
2005-2002	5.49	2.81	8.18	0.0000
2005-2003	1.68	-1.00	4.36	0.3714

Moisture Content in the Control Cells



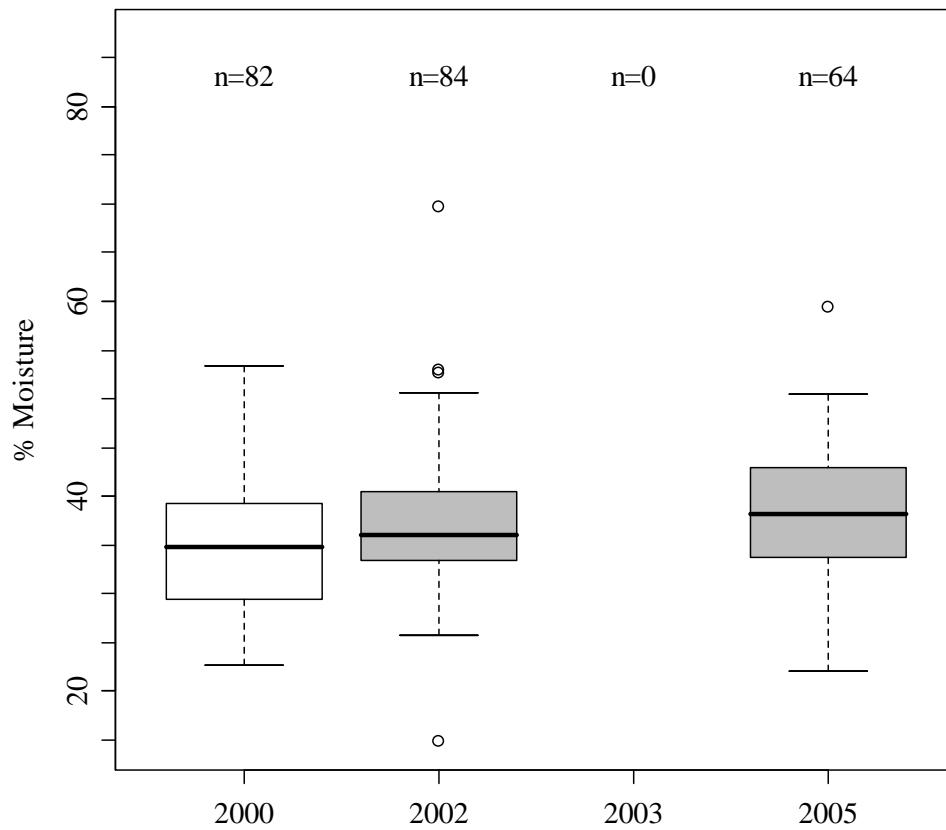
ANOVA Summary Tables and Boxplots for the Retrofit cells

The F-test p-value indicates that at least two mean moisture content levels are significantly different. The Tukey multiple comparisons indicate the 2005 and 2002 mean moisture content levels are equal and both are significantly greater than the 2000 mean moisture content. The boxplots do not provide any evidence of trend. These results indicate no trend in mean moisture content with sampling date.

F-test p-value	0.0023
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Years	Estimated Difference	Lower Bound of CI	Upper Bound of CI	Adjusted p-value
2002-2000	2.52	0.03	5.02	0.0468
2005-2000	3.89	1.21	6.57	0.0021
2005-2002	1.36	-1.30	4.03	0.4501

Moisture Content in the Retrofit Cells



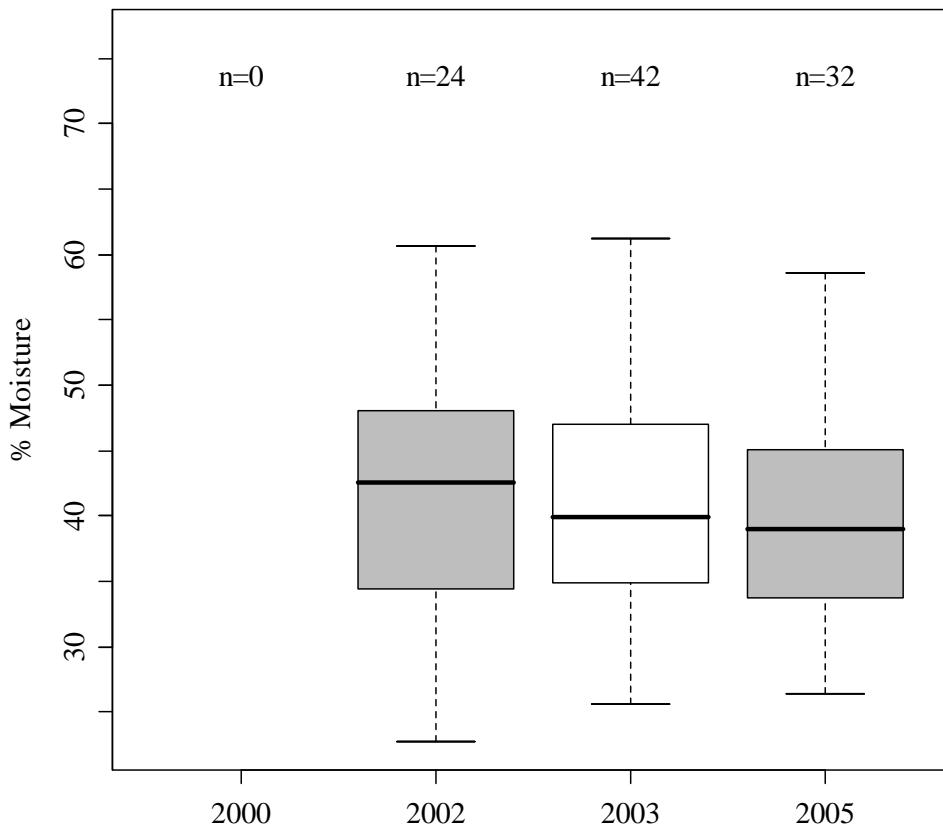
ANOVA Summary Tables and Boxplots for As-Built cell A

The *F*-test p-value indicates there are no differences between mean moisture content levels. The boxplots also indicate no differences are present. Therefore, there is no evidence of trend in mean moisture content with sampling date.

F-test p-value	0.6526
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Years	Estimated Difference	Lower Bound of CI	Upper Bound of CI	Adjusted p-value
2003-2002	-0.83	-5.91	4.24	0.9192
2005-2002	-2.04	-7.40	3.32	0.6382
2005-2003	-1.20	-5.86	3.45	0.8120

Moisture Content in As-built Cell A



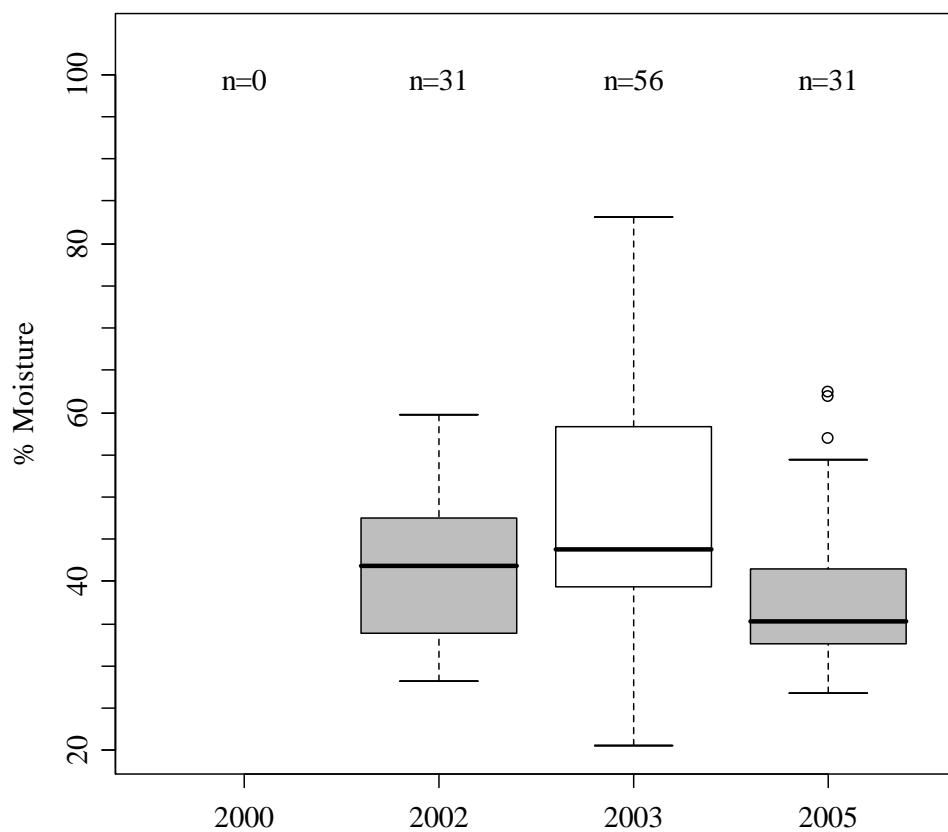
ANOVA Summary Tables and Boxplots for As-Built cell B

The *F*-test p-value indicates that at least two mean moisture content levels are significantly different. The Tukey multiple comparisons and the boxplots indicate the 2003 mean is higher than the 2002 mean and the 2005 mean. Therefore, there is no evidence of trend in mean moisture content with sampling date.

F-test p-value	0.0026
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Years	Estimated Difference	Lower Bound of CI	Upper Bound of CI	Adjusted p-value
2003-2002	7.08	0.12	14.04	0.0452
2005-2002	-2.52	-10.41	5.38	0.7303
2005-2003	-9.60	-16.55	-2.64	0.0040

Moisture Content in As-built Cell B



Appendix D

**COMPARISON OF MEASURED MOISTURE
CONTENT TO CALCULATED MOISTURE
CONTENT**

Summary Statistics Tables and Boxplots

The summary statistics included the sample size (N), minimum (Min), maximum (Max), the mean and the standard deviation, the t-test and WRS p-values. If the p-values are greater than 0.05, then the compared values are considered similar and if the p-values are between 0.05 and 0.1, the compared values are considered marginally similar. The boxplots provide a qualitative mean of comparing the distribution of the calculated and measured moisture content. Note that the min, max, mean and standard deviation represented in the summary statistics tables have the units of percent by mass.

Summary Statistics for the Control cells

Year	Type	N	Min	Mean	Max	Std Dev	t-test p-value	WRS p-value
2002	Measured	70	18.41	32.49	42.20	4.94	0.0280	0.0119
	Calculated	20	30.55	31.15	32.00	0.41		
2003	Measured	71	26.71	36.31	63.72	5.92	0.0000	0.0000
	Calculated	24	29.35	29.74	30.55	0.38		
2005	Measured	58	24.98	37.99	47.50	5.60	0.0000	0.0000
	Calculated	24	29.55	29.62	29.72	0.04		

Summary Statistics for the Retrofit cells

Year	Type	N	Min	Mean	Max	Std Dev	t-test p-value	WRS p-value
2002	Measured	84	14.83	37.26	69.63	7.52	0.7237	0.1762
	Calculated	20	37.02	37.55	37.81	0.24		
2005	Measured	64	22.00	38.63	59.44	6.77	0.2774	0.4999
	Calculated	24	37.62	37.70	37.75	0.05		

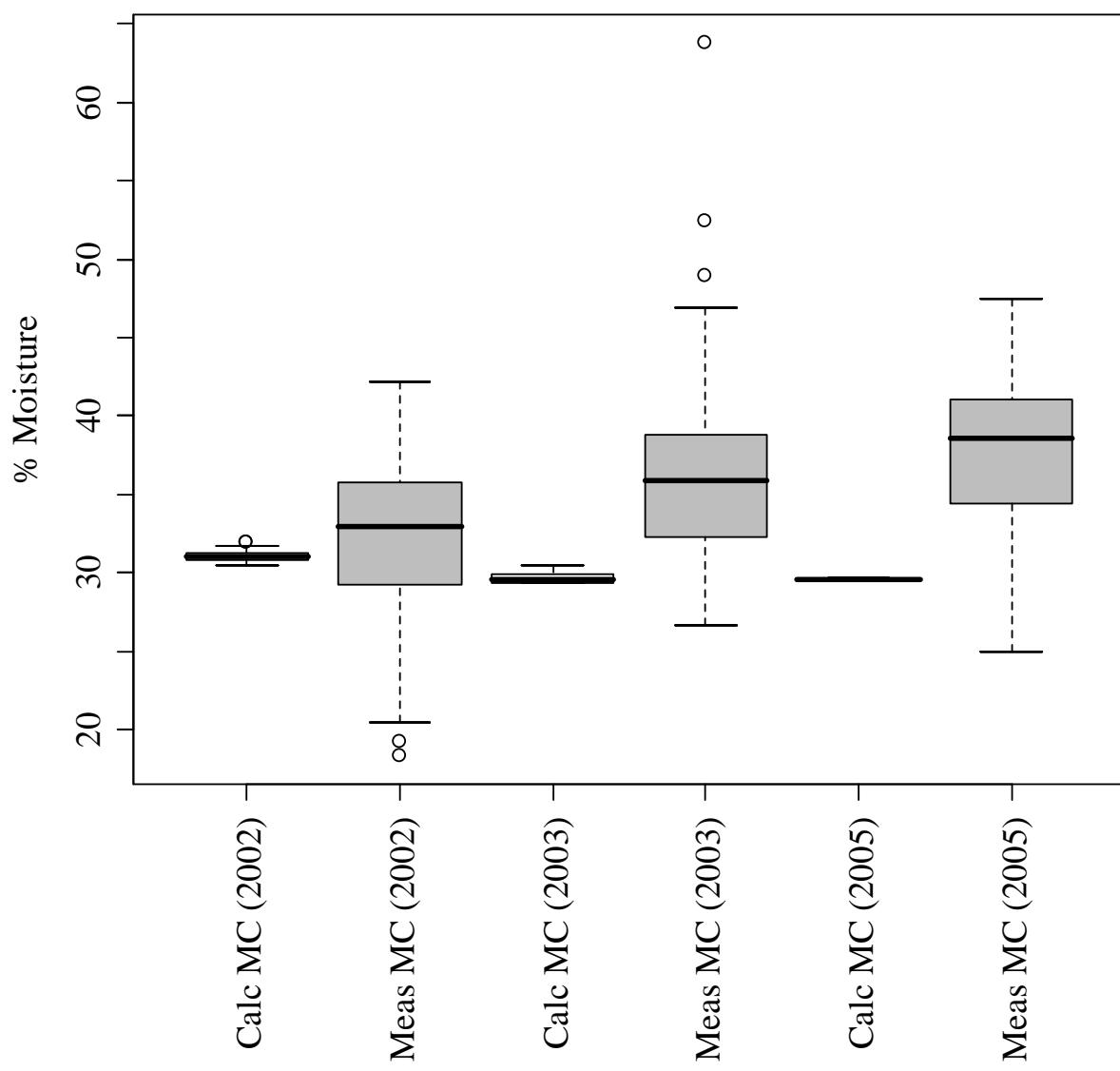
Summary Statistics for As-Built cell A

Year	Type	N	Min	Mean	Max	Std Dev	t-test p-value	WRS p-value
2002	Measured	24	22.75	41.91	60.69	9.19	0.0010	0.0015
	Calculated	20	42.55	49.29	55.08	3.45		
2003	Measured	42	25.58	41.07	61.24	8.34	0.0006	0.0011
	Calculated	24	43.33	46.13	49.55	2.33		
2005	Measured	32	26.36	39.87	58.53	7.63	0.0000	0.0000
	Calculated	24	48.51	50.35	52.16	1.17		

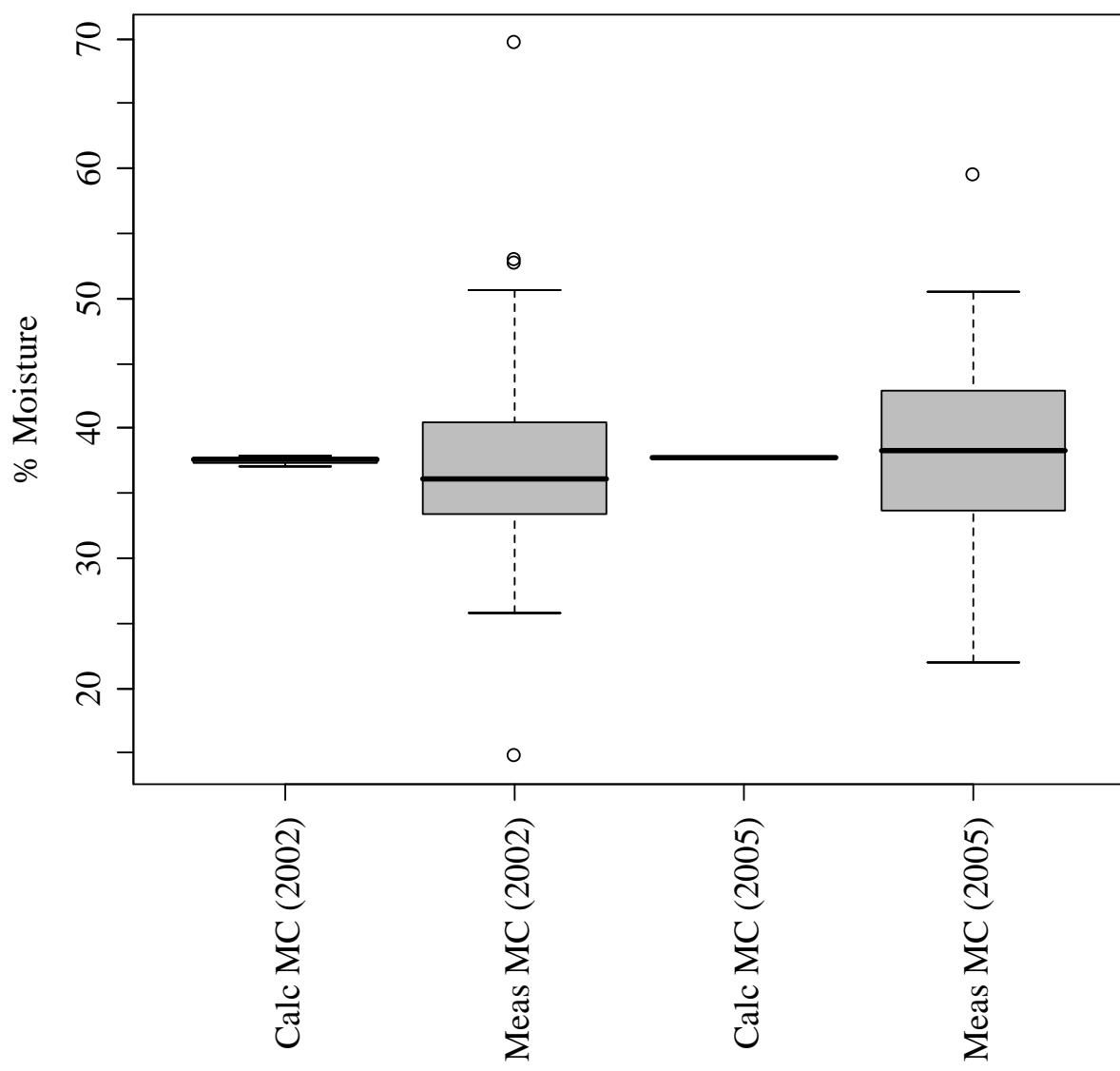
Summary Statistics for As-Built cell B

Year	Type	N	Min	Mean	Max	Std Dev	t-test p-value	WRS p-value
2002	Measured	31	28.19	41.56	59.68	8.97	0.1177	0.0896
	Calculated	20	41.72	44.19	45.55	1.12		
2003	Measured	56	20.60	48.64	83.07	16.25	0.6492	0.0449
	Calculated	24	44.99	47.64	49.80	1.71		
2005	Measured	31	26.81	39.05	62.45	9.61	0.0000	0.0000
	Calculated	24	48.34	49.15	49.69	0.49		

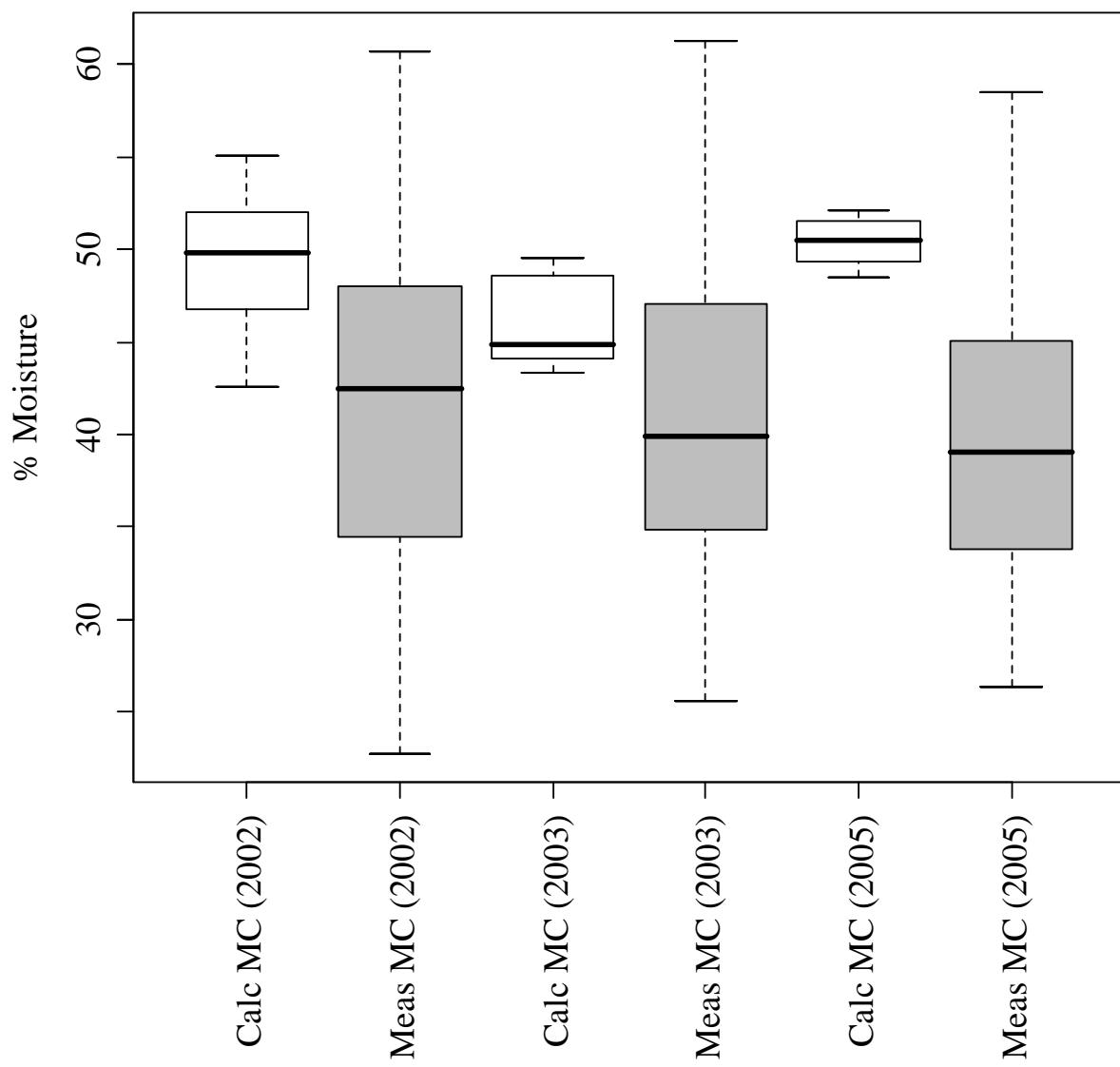
Calculated Versus Measured Moisture Content in the Control Cells



Calculated Versus Measured Moisture Content in the Retrofit Cells



Calculated Versus Measured Moisture Content in As-built Cell A



Appendix E

HAZARDOUS AIR POLLUTANT SUMMARY STATISTICS

Control cell A and B Results

TableD-1 HAP Results for Control cell A (ppm)

Parameter	Number of Detects	Range (min-max)	Median	Mean ± Standard Deviation
1,2,4-Trimethylbenzene	14	2.808-12.699	6.51	6.912±3.569
1,2-Dichloro-1,1,2,2-tetrafluoroethane	4	0.212-0.568	0.394	0.367±0.154
1,3,5-Trimethylbenzene	14	1.094-4.615	2.296	2.494±1.186
1,4-Dichlorobenzene	12	0.544-2.329	0.946	1.15±0.516
2-Butanone (MEK)	14	26.531-124.988	41.13	53.02±28.82
4-Ethyltoluene	14	2.691-13.076	6.337	7.049±3.549
4-Methyl-2-pentanone (MIBK)	14	3.178-18.422	7.278	8.882±4.778
Acetone	14	11.582-119.737	35.971	46.68±30.881
Benzene	13	0.407-3.959	0.749	0.974±0.888
cis-1,2-Dichloroethene	11	0.296-1.667	0.568	0.75±0.385
Dichlorodifluoromethane	14	0.784-2.969	1.622	1.672±0.604
Ethylbenzene	14	6.717-16.153	9.501	10.009±2.882
Methylene chloride	5	0.384-2.808	0.929	1.149±0.874
Styrene	13	0.747-4.811	1.89	2.021±0.974
Tetrachloroethene	12	0.296-1.568	0.902	0.897±0.429
Toluene	14	31.344-78.839	41.526	44.018±12.362
Total NMOCs as Hexane	14	383-1608	1146	1060±368
Trichloroethene	10	0.273-0.792	0.632	0.589±0.172
Vinyl chloride	4	0.228-1.03	0.568	0.609±0.288
Xylenes (total)	14	15.79-48.649	30.192	29.967±9.517

Table D-2 HAP Results for Control cell B (ppm)

Parameter	Number of Detects	Range (min-max)	Median	Mean ± Standard Deviation
1,1-Dichloroethane	3	0.138-0.44	0.152	0.252±0.145
1,2,4-Trimethylbenzene	14	1.702-6.737	3.59	3.492±1.489
1,3,5-Trimethylbenzene	14	0.682-2.474	1.388	1.405±0.54
1,4-Dichlorobenzene	9	0.374-1.985	0.774	0.866±0.459
2-Butanone (MEK)	14	4.316-26.843	13.329	13.489±7.234
4-Ethyltoluene	14	1.932-7.474	4.038	4.076±1.711
4-Methyl-2-pentanone (MIBK)	12	0.737-6.773	2.005	2.481±1.766
Acetone	13	4.757-21.579	9.782	10.656±4.897
Benzene	14	0.295-1.165	0.616	0.669±0.234
cis-1,2-Dichloroethene	14	0.253-1.694	0.738	0.771±0.385
Dichlorodifluoromethane	14	0.337-3.646	1.224	1.427±0.876
Ethylbenzene	14	5.516-12.053	7.972	8.279±2.263
Methylene chloride	5	0.152-1.302	0.821	0.765±0.38
Styrene	13	0.823-2.487	1.129	1.216±0.466
Tetrachloroethene	14	0.152-1.482	0.504	0.59±0.388
Toluene	14	15.79-53.41	34.652	34.754±12.518
Total NMOCs as Hexane	14	450-867	633	611±117
Trichloroethene	10	0.091-0.911	0.27	0.37±0.262
Vinyl chloride	13	0.364-1.641	1.053	0.987±0.44
Xylenes (total)	14	16.843-33.334	20.389	23.487±6.21

As-Built cells A and B Results

Table D-3 HAP Results for As-Built cell A (ppm)

Parameter	Number of Detects	Range (min-max)	Median	Mean ± Standard Deviation
1,2,4-Trimethylbenzene	10	0.068-5.417	2.393	2.485±1.814
1,3,5-Trimethylbenzene	9	0.274-2.41	1.099	1.238±0.746
1,4-Dichlorobenzene	7	0.31-0.969	0.566	0.603±0.243
2-Butanone (MEK)	9	0.45-17.978	3.855	5.075±5.226
4-Ethyltoluene	10	0.087-5.73	3.164	2.961±1.828
4-Methyl-2-pentanone (MIBK)	7	1.6-4.167	2.531	2.675±0.961
Acetone	10	0.596-17.978	3.994	5.211±5.179
Benzene	10	0.39-1.686	1.032	1.037±0.419
cis-1,2-Dichloroethene	8	0.291-1.979	0.641	0.739±0.54
Dichlorodifluoromethane	10	0.455-1.512	0.899	0.946±0.328
Ethylbenzene	10	0.731-13.542	8.928	8.02±3.97
Styrene	9	0.453-1.649	1.035	1.013±0.422
Tetrachloroethene	6	0.14-0.583	0.293	0.334±0.184
Toluene	9	10.675-37.079	20.931	23.598±9.462
Total NMOCs as Hexane	10	97-633	458	393±177
Trichloroethene	5	0.187-0.539	0.335	0.346±0.17
Vinyl chloride	8	0.192-1.798	0.854	0.786±0.512
Xylenes (total)	10	1.461-30.209	17.889	16.932±9.12

Table D-4 HAP Results for As-Built cell B (ppm)

Parameter	Number of Detects	Range (min-max)	Median	Mean ± Standard Deviation
1,1-Dichloroethane	3	0.072-0.103	0.091	0.091±0.013
1,2,4-Trimethylbenzene	9	0.558-3.474	2.389	2.122±0.84
1,3,5-Trimethylbenzene	9	0.306-1.685	1.035	0.957±0.375
1,4-Dichlorobenzene	8	0.233-0.548	0.346	0.353±0.098
2-Butanone (MEK)	8	0.292-6.422	1.059	2.167±2.329
4-Ethyltoluene	10	0.088-4.316	2.64	2.587±1.259
Acetone	8	0.178-23.256	1.413	4.301±7.785
Benzene	10	0.585-1.349	0.901	0.921±0.268
Chlorobenzene	4	0.058-0.54	0.099	0.183±0.186
cis-1,2-Dichloroethene	9	0.115-1.442	0.209	0.392±0.419
Dichlorodifluoromethane	10	0.466-1.644	0.806	0.929±0.354
Ethylbenzene	10	0.798-13.685	7.999	7.583±3.412
Methylene chloride	5	0.027-1.053	0.562	0.544±0.439
Styrene	7	0.103-1.396	0.513	0.61±0.391
Tetrachloroethene	4	0.043-0.419	0.114	0.168±0.147
Toluene	10	4.271-43.256	10.62	14.768±11.361
Total NMOCs as Hexane	10	85-467	233	242±100
Trichloroethene	4	0.034-0.512	0.124	0.184±0.189
Trichlorofluoromethane	4	0.04-0.836	0.225	0.348±0.334
Vinyl chloride	10	0.479-1.911	1.043	1.07±0.419
Xylenes (total)	10	1.574-27.369	17.636	16.67±7.061

Retrofit cells A and B Results

Table D-6 HAP Results for Retrofit cell A (ppm)

Parameter	Number of Detects	Range (min-max)	Median	Mean ± Standard Deviation
1,1-Dichloroethane	8	0.046-0.135	0.059	0.076±0.033
1,2,4-Trimethylbenzene	15	1.349-4.458	2.472	2.433±0.749
1,3,5-Trimethylbenzene	15	0.582-1.567	0.977	0.994±0.263
1,4-Dichlorobenzene	15	0.2-1	0.708	0.665±0.234
2-Butanone (MEK)	10	0.229-5.648	0.925	1.815±1.83
4-Ethyltoluene	15	1.574-3.615	2.605	2.542±0.595
4-Methyl-2-pentanone (MIBK)	8	0.229-2.118	1.045	0.978±0.6
Acetone	10	0.229-6.236	0.678	1.521±1.733
Benzene	15	0.244-0.634	0.469	0.464±0.089
Chlorobenzene	8	0.048-0.1	0.07	0.074±0.018
cis-1,2-Dichloroethene	15	0.194-0.695	0.363	0.4±0.154
Dichlorodifluoromethane	15	0.176-1.183	0.512	0.54±0.258
Ethylbenzene	15	2.973-7.033	5.625	5.577±0.989
Toluene	15	3.109-19.673	8.193	9.736±5.086
Total NMOCs as Hexane	15	63-350	250	246±73
Vinyl chloride	15	0.349-1.223	0.477	0.535±0.224
Xylenes (total)	15	7.568-16.394	12.904	12.959±2.493

Table D-5 HAP Results for Retrofit cell B (ppm)

Parameter	Number of Detects	Range (min-max)	Median	Mean ± Standard Deviation
1,1-Dichloroethane	6	0.019-0.082	0.047	0.051±0.019
1,2,4-Trimethylbenzene	14	1.137-4.253	2.131	2.38±0.941
1,3,5-Trimethylbenzene	14	0.546-1.691	0.831	1.011±0.376
1,4-Dichlorobenzene	14	0.226-0.958	0.506	0.545±0.25
2-Butanone (MEK)	12	0.14-13.112	2.578	3.096±3.537
4-Ethyltoluene	14	1.516-4.223	2.26	2.624±0.82
4-Methyl-2-pentanone (MIBK)	10	0.167-2.667	1.007	1.152±0.709
Acetone	12	0.121-10.445	1.937	2.971±3.006
Benzene	14	0.182-0.712	0.401	0.422±0.143
Chlorobenzene	9	0.038-0.115	0.068	0.071±0.023
cis-1,2-Dichloroethene	13	0.059-1	0.103	0.279±0.298
Dichlorodifluoromethane	14	0.182-1.079	0.506	0.543±0.264
Ethylbenzene	14	2.576-7.556	5.711	5.356±1.341
Toluene	14	2.425-22.223	8.204	10.104±6.696
Total NMOCs as Hexane	14	143-383	250	237±71
Vinyl chloride	14	0.167-1.291	0.371	0.442±0.296
Xylenes (total)	14	6.97-21.556	14.296	14.096±3.829

Appendix F

ASSESSMENT OF LEACHATE PARAMETERS

Leachate Parameters Quantifying Trends

Multiple linear regressions were utilized to quantify trends in the leachate parameters of interest. Two explanatory variables were used in the regression fits – sampling date and a phase-shifted sine function of the sampling date (to capture a possible seasonal component). The sine variable was phase-shifted to have maximum on September 1st and minimum on March 1st. For the regression fits, the parameter Sampling Date is the number of days between the sampling date and 1/1/1970.

The seasonal explanatory variable improved the fit for temperature only. It is possible the seasonal explanatory variable improves the fit for TOC in the Control and Retrofit cells. However, TOC has only been measured since February of 2004 so with the high variability present, any determination concerning trend is tenuous. Therefore, regression fits and Time plots for all parameters, except temperature, use sampling date as the only explanatory variable.

Note that due to the drop in sample results for Control cell A following December 2004, no model was used to explain trends in this cell.

The tables below include regression estimates, adjusted-R² values, and confidence intervals for the regression coefficients. Time plots display the individual samples and the regression fits. While not presented, several diagnostic plots were analyzed to ensure linear regression model assumptions were met and to investigate the influence of individual points upon the fit. A list of influential points is also provided in this section. A plot of residuals versus fitted values was used to assess the assumption of constant error variance. A normal quantile-quantile plot was used to assess the assumption that errors are distributed normally. A residuals versus leverage plot was used to investigate the influence of individual points on the regression fit. Specific analysis of the regression of each parameter of interest is presented in the following sections.

Temperature (°C)

The fits are adequate with almost all adjusted-R² values ranging between 0.5 and 0.7. Significant positive trends are seen in the Control cells and the As-Built cells. Retrofit cell A shows a significant negative trend while Retrofit cell B shows no significant trend.

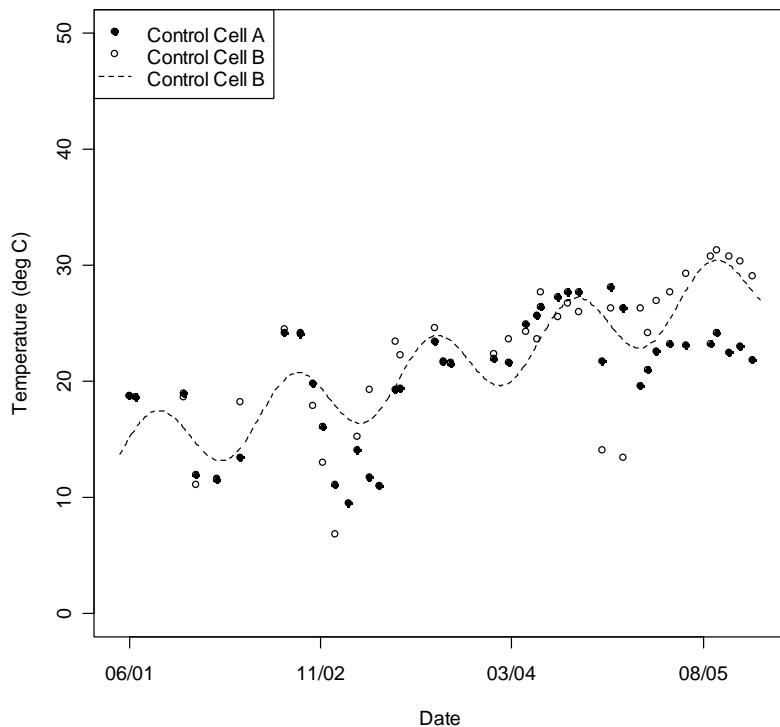
Investigation of the diagnostic plots indicates that model assumptions are met reasonably well. The residual variance appears constant in all cells and the residuals appear to be distributed approximately normal. Samples dated 12/16/2002, 11/16/2004, and 1/10/2005 from Control cell B have large residuals which appear to violate the normality assumption and are slightly influential on the regression fit. Investigation of these data points is probably warranted. In addition, the first sample from As-Built cell A and the first two samples from As-Built cell B are slightly influential on the regression fits.

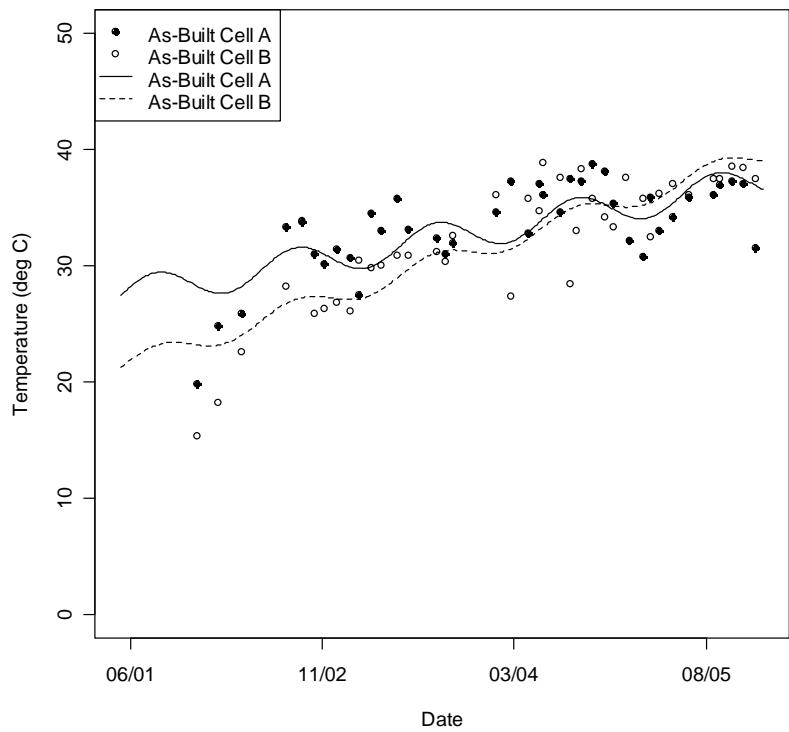
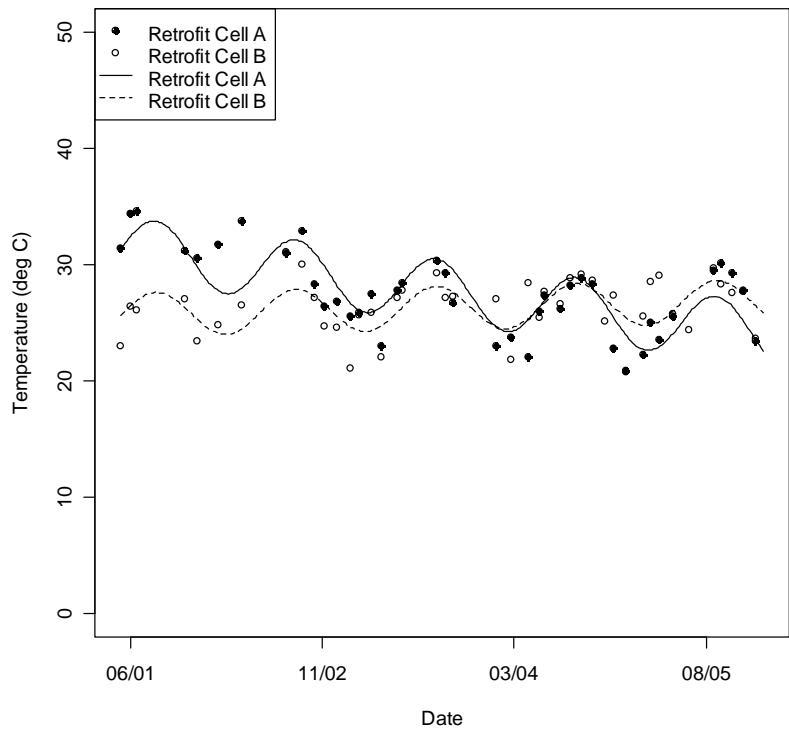
Regression Fits

Landfill Unit	Intercept		Sampling Date		Sine of Sampling Date		Adjusted-R ²
	Estimate	p-value	Estimate	p-value	Estimate	p-value	
Control cell A	-57.01	0.0003	0.0063	0.0000	3.4315	0.0001	0.5593
Control cell B	-87.90	0.0000	0.0089	0.0000	2.9336	0.0035	0.5547
Retrofit cell A	82.31	0.0000	-0.0044	0.0000	2.7095	0.0000	0.6318
Retrofit cell B	17.71	0.0342	0.0007	0.2927	1.8678	0.0002	0.2896
As-Built cell A	-39.89	0.0062	0.0059	0.0000	1.4123	0.0309	0.4888
As-Built cell B	-103.79	0.0000	0.0109	0.0000	0.8976	0.1913	0.6959

Landfill Unit	Intercept		Sampling Date		Sine of Sampling Date	
	95 % CI Lower	95 % CI Upper	95 % CI Lower	95 % CI Upper	95 % CI Lower	95 % CI Upper
	-85.76	-28.27	0.0039	0.0086	1.8961	4.9669
Control cell A						
Control cell B	-123.24	-52.56	0.0060	0.0117	1.0270	4.8403
Retrofit cell A	64.85	99.76	-0.0058	-0.0030	1.7584	3.6606
Retrofit cell B	1.39	34.02	-0.0006	0.0020	0.9624	2.7733
As-Built cell A	-67.72	-12.06	0.0036	0.0081	0.1377	2.6870
As-Built cell B	-134.13	-73.44	0.0085	0.0133	-0.4686	2.2638

Time plots





pH (-log+H)

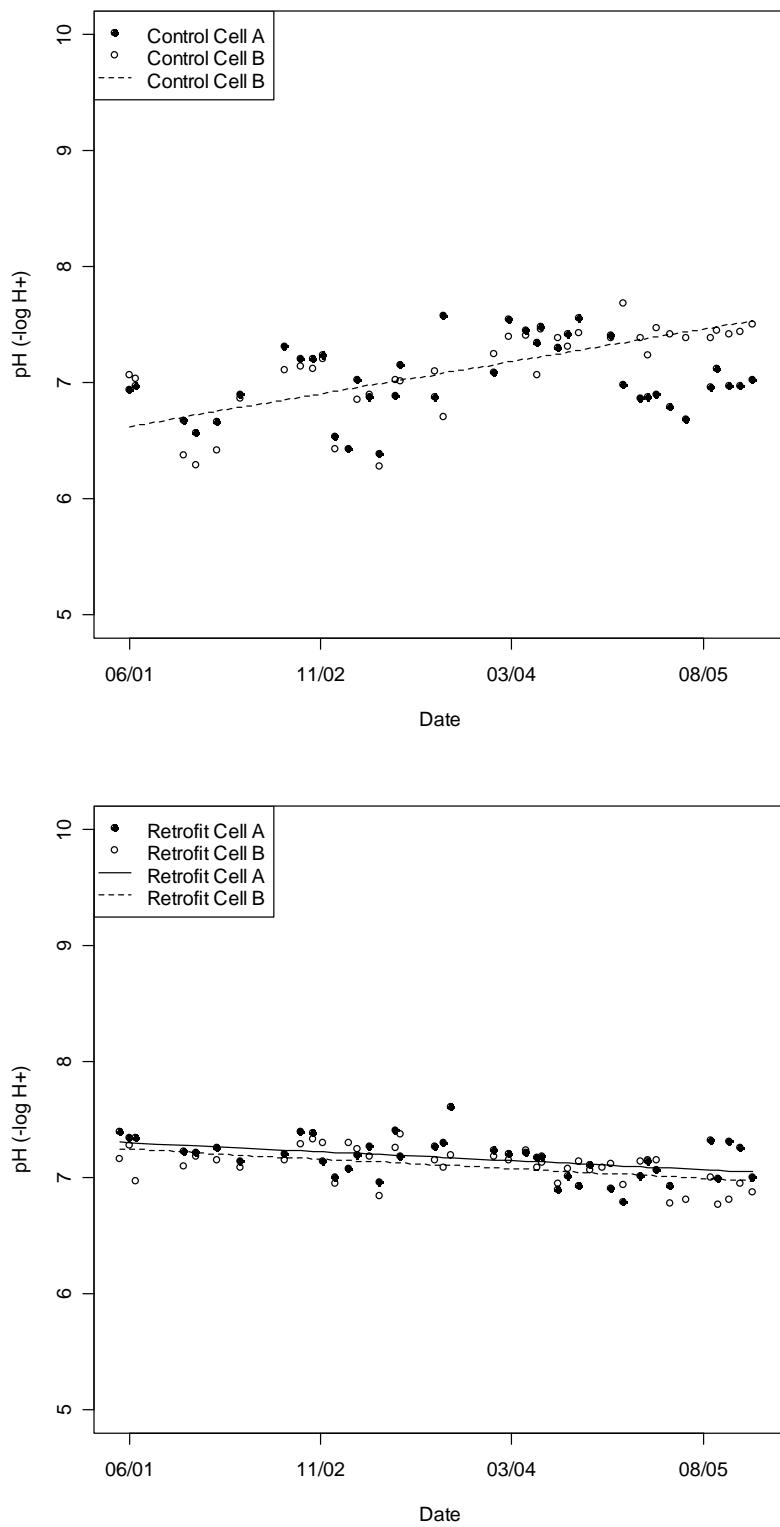
As with temperature, there are significant increasing pH trends in the Control cells and As-Built cells, and significant decreasing trends in the Retrofit cells. The model fits are only average as seen in the adjusted-R² values. The pH time plots indicate a seasonal component may be present, but when this component was added to the model, the regression fits did not improve. In summary, while the model fits are not spectacular, linear trends appear appropriate and significant. Investigation of the diagnostic plots indicated the linear regression assumptions were generally met. The residual variance for Control cell B appears to decrease slightly with time. Several samples in the As-Built cell Are below 6.5 and are slightly influential on the regression fit.

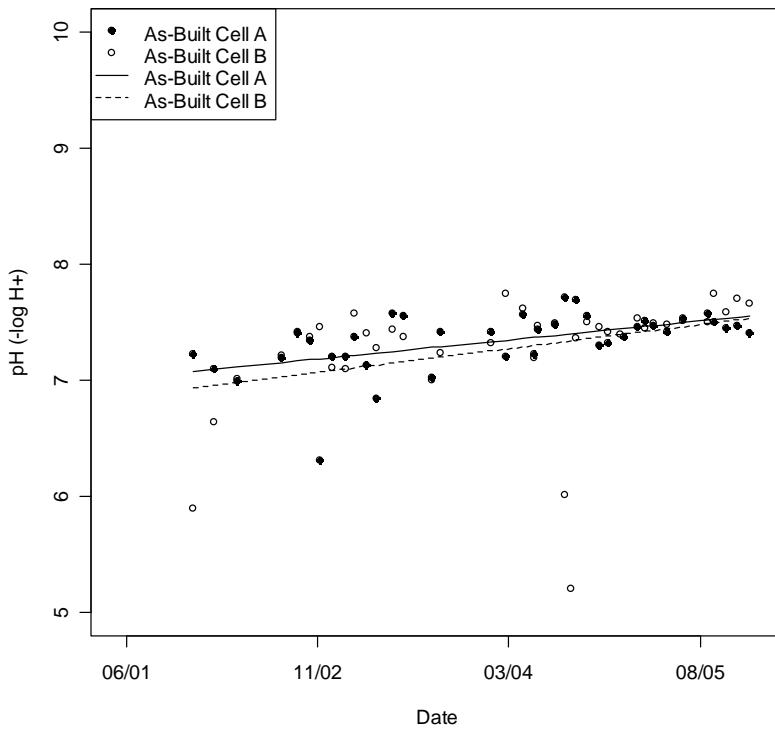
Regression Fits

Landfill Unit	Intercept		Sampling Date		Adjusted-R ²
	Estimate	p-value	Estimate	p-value	
Control cell A	5.18	0.0003	0.0001	0.1605	0.0269
Control cell B	0.20	0.8496	0.0006	0.0000	0.5263
Retrofit cell A	9.08	0.0000	-0.0002	0.0041	0.1721
Retrofit cell B	9.16	0.0000	-0.0002	0.0003	0.2565
As-Built cell A	3.24	0.0040	0.0003	0.0004	0.2760
As-Built cell B	2.16	0.3683	0.0004	0.0376	0.0877

Landfill Unit	Intercept		Sampling Date	
	95 % CI Lower	95 % CI Upper	95 % CI Lower	95 % CI Upper
Control cell A	2.57	7.79	-0.0001	0.0004
Control cell B	-1.96	2.37	0.0004	0.0007
Retrofit cell A	7.81	10.35	-0.0003	-0.0001
Retrofit cell B	8.10	10.22	-0.0003	-0.0001
As-Built cell A	1.10	5.38	0.0002	0.0005
As-Built cell B	-2.64	6.96	0.0000	0.0008

Time plots





Volatile Organic Acids - Acetic Acid (mg/L)

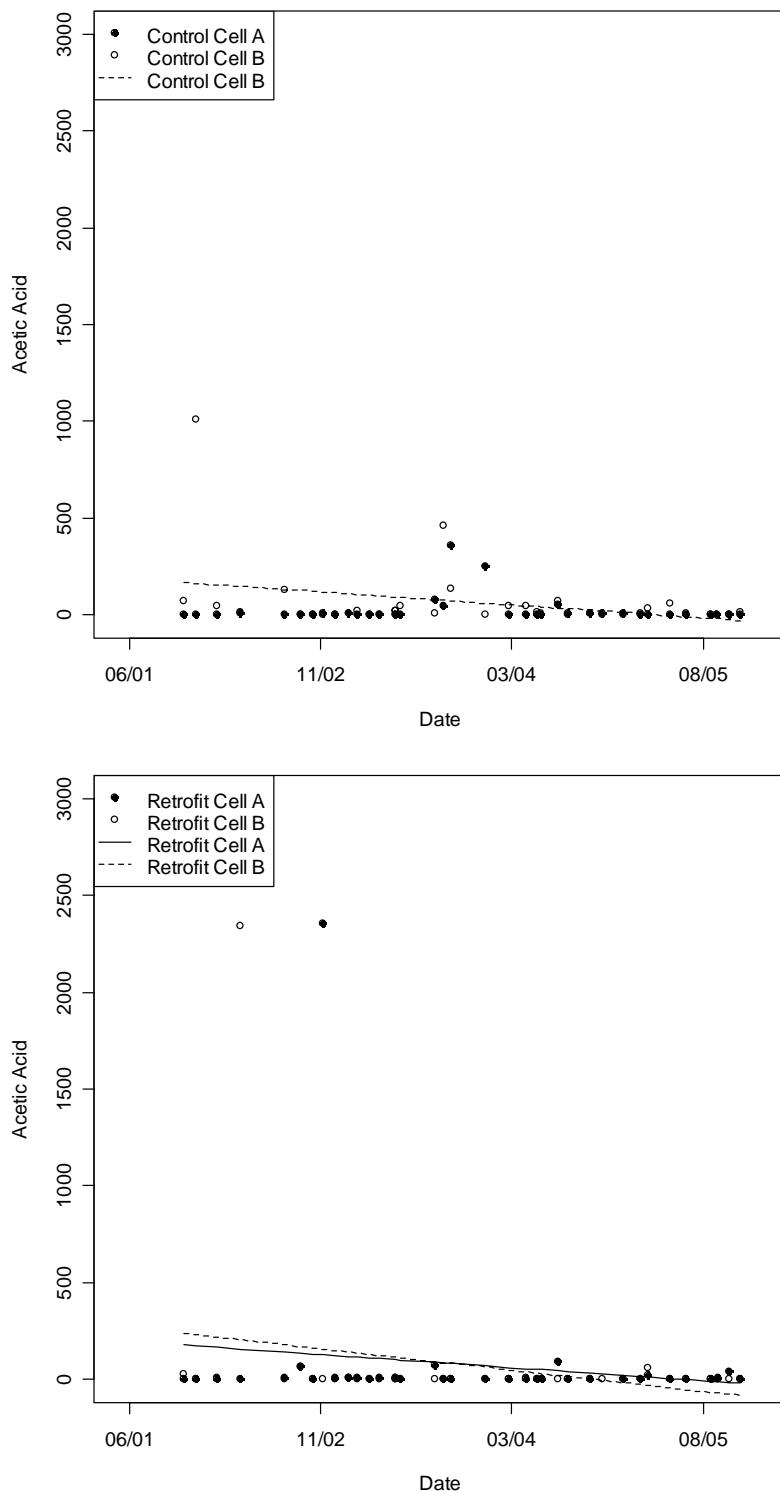
All of the cells indicate a linear model is not appropriate. Control cell A and the Retrofit cells all have large percentage of non-detects (approximately 50% non-detects). Control cell A also has a spike in concentrations in late-2003 to early-2004. The Retrofit cells each have a very large sample in 2002. Control cell B has a large sample early and a spike in concentrations in late-2003. Finally, the time plots for the As-Built cells show large variability and have a pattern that indicates a linear model is not appropriate. Note that acetic acid and propionic acid concentrations exhibited similar patterns.

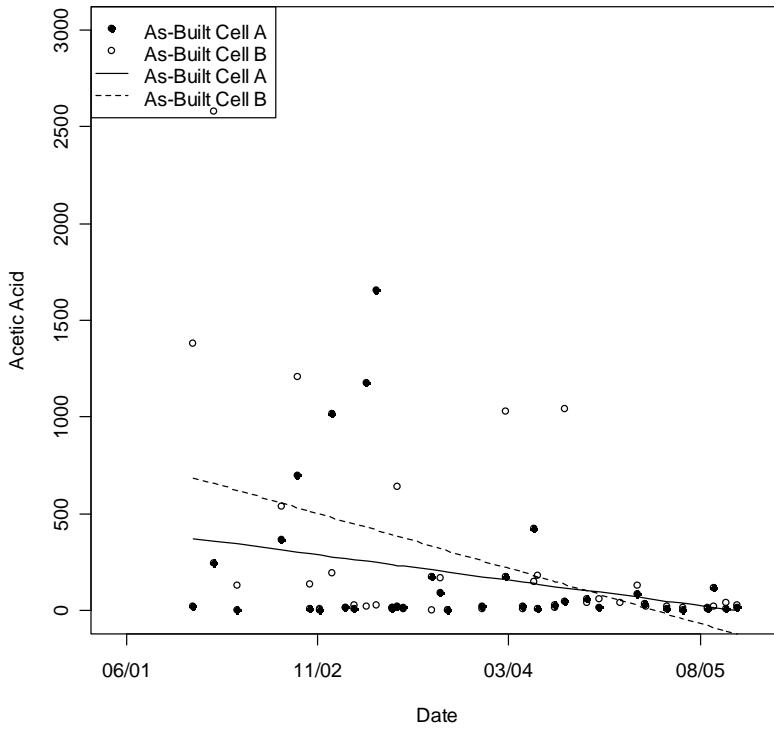
Regression Fits

Landfill Unit	Intercept		Sampling Date		Adjusted-R ²
	Estimate	p-value	Estimate	p-value	
Control cell A	36.5	0.9174	-0.0011	0.9685	-0.0285
Control cell B	1728.6	0.0497	-0.1343	0.0579	0.0753
Retrofit cell A	1762.5	0.3637	-0.1363	0.3837	-0.0064
Retrofit cell B	2797.9	0.1346	-0.2202	0.1438	0.0332
As-Built cell A	3431.4	0.0741	-0.2621	0.0898	0.0553
As-Built cell B	7314.8	0.0057	-0.5679	0.0075	0.1639

Landfill Unit	Intercept		Sampling Date	
	95 % CI Lower	95 % CI Upper	95 % CI Lower	95 % CI Upper
Control cell A	-671.8	744.7	-0.0582	0.0560
Control cell B	2.6	3454.6	-0.2734	0.0048
Retrofit cell A	-2127.8	5652.8	-0.4502	0.1776
Retrofit cell B	-910.2	6506.0	-0.5192	0.0788
As-Built cell A	-352.8	7215.7	-0.5671	0.0429
As-Built cell B	2270.7	12358.8	-0.9741	-0.1617

Time plots





Volatile Organic Acids - Propionic Acid (mg/L)

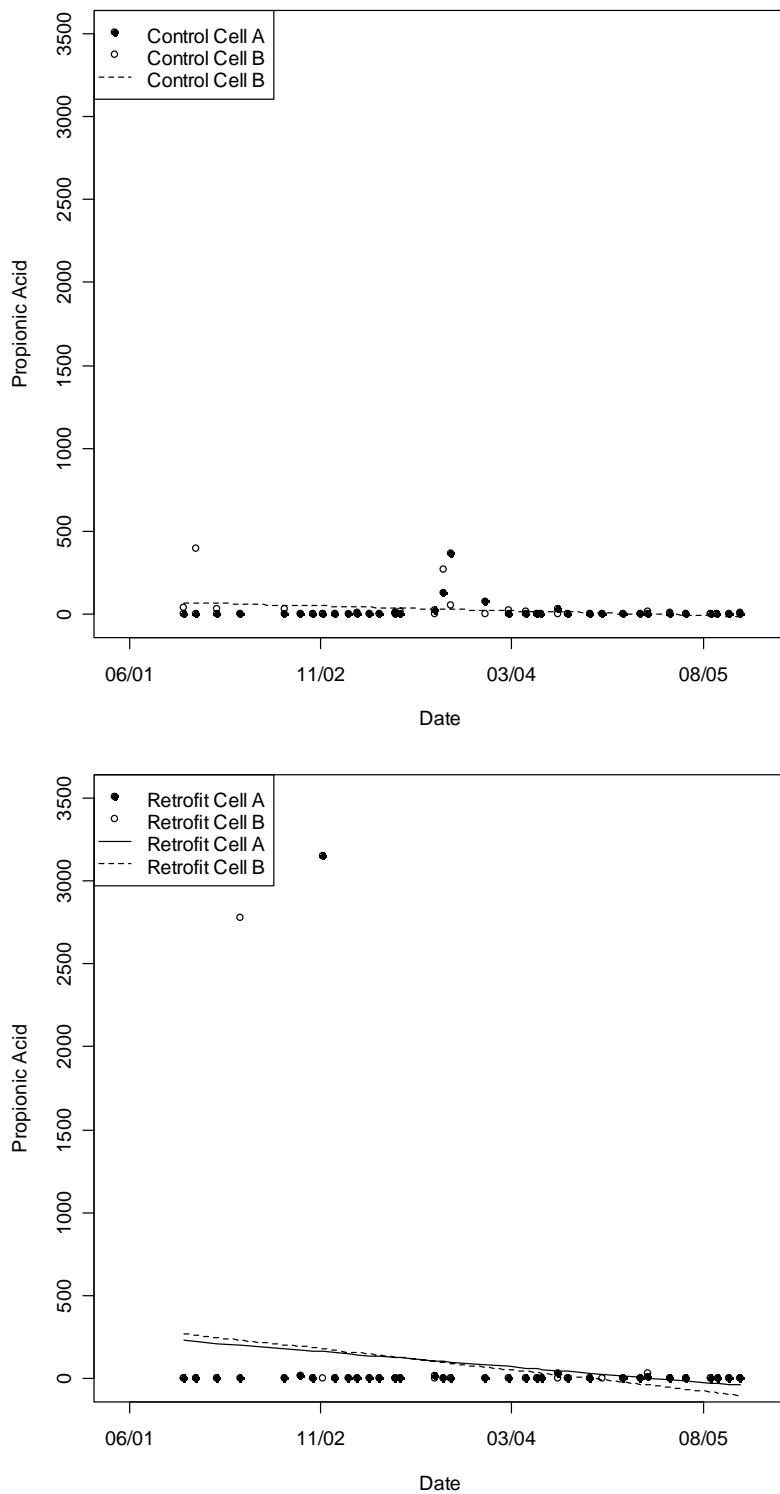
All of the cells indicate a linear model is not appropriate. All cells have a large percentage of non-detects (ranging from 38% to 86% non-detects). Control cell A also has a spike in concentrations in late-2003 to early-2004. The Retrofit cells each have a very large sample in 2002. Control cell B has a large sample early and a spike in concentrations in late-2003. Finally, the time plots for the As-Built cells show large variability and have a pattern that indicates a linear model is not appropriate. Propionic acid concentrations followed a pattern similar to that of acetic acid concentrations.

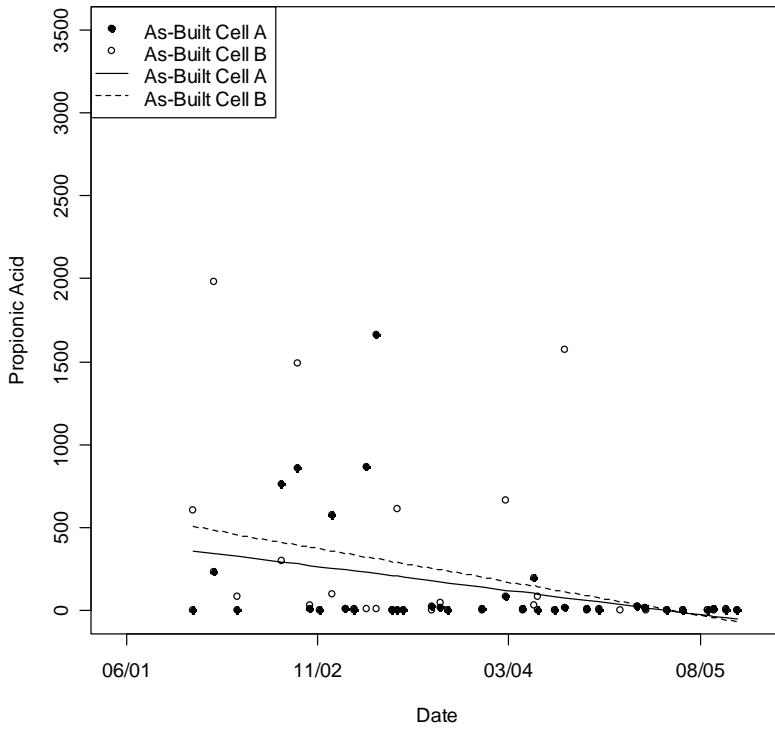
Regression Fits

Landfill Unit	Intercept		Sampling Date		Adjusted-R ²
	Estimate	p-value	Estimate	p-value	
Control cell A	61.2	0.8451	-0.0035	0.8885	-0.0280
Control cell B	736.5	0.0516	-0.0573	0.0596	0.0741
Retrofit cell A	2375.1	0.3611	-0.1845	0.3791	-0.0059
Retrofit cell B	3243.8	0.1446	-0.2555	0.1538	0.0303
As-Built cell A	3757.5	0.0386	-0.2910	0.0463	0.0856
As-Built cell B	5182.8	0.0319	-0.4009	0.0388	0.0911

Landfill Unit	Intercept		Sampling Date	
	95 % CI Lower	95 % CI Upper	95 % CI Lower	95 % CI Upper
Control cell A	-570.1	692.5	-0.0544	0.0474
Control cell B	-5.5	1478.5	-0.1171	0.0024
Retrofit cell A	-2839.2	7589.4	-0.6053	0.2362
Retrofit cell B	-1169.3	7657.0	-0.6113	0.1003
As-Built cell A	209.3	7305.7	-0.5770	-0.0050
As-Built cell B	475.8	9889.8	-0.7800	-0.0219

Time plots





Total Organic Carbon, TOC (mg/L)

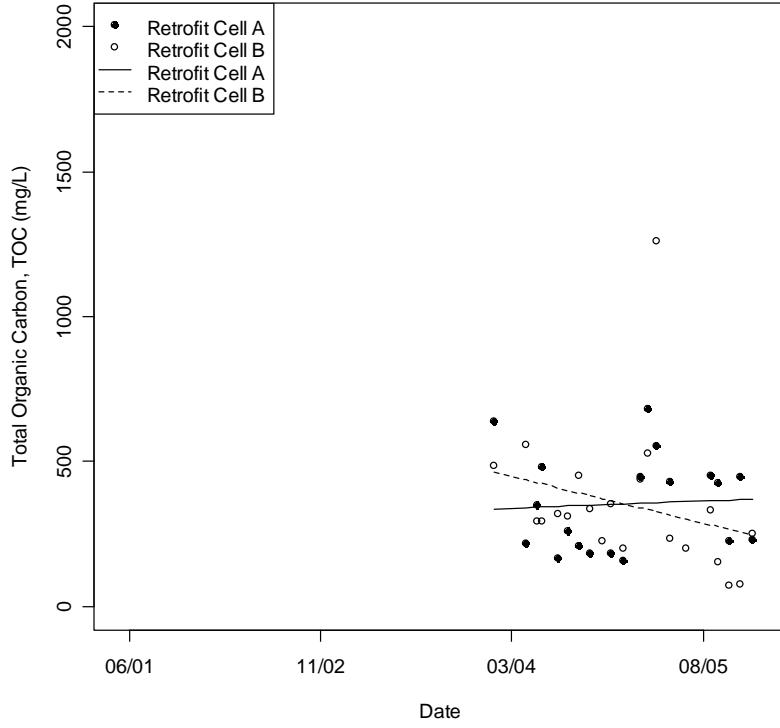
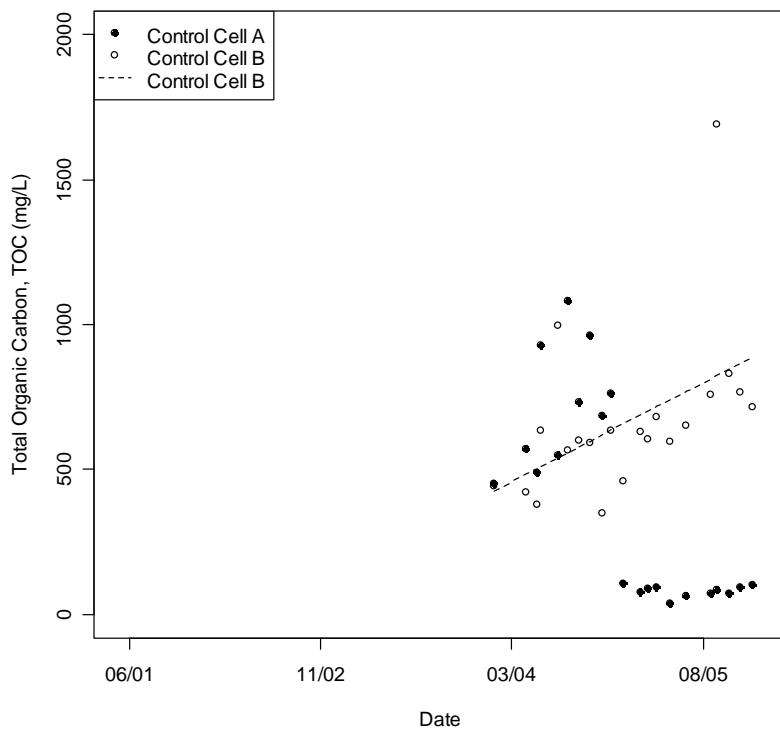
Inspection of the time plots indicates a high degree of variability over the shorter sampling range. At this point in time, no trend model appears appropriate. In a qualitative sense, the time plots indicate a potential increasing trend in Control cell B and a decreasing trend in Retrofit cell B.

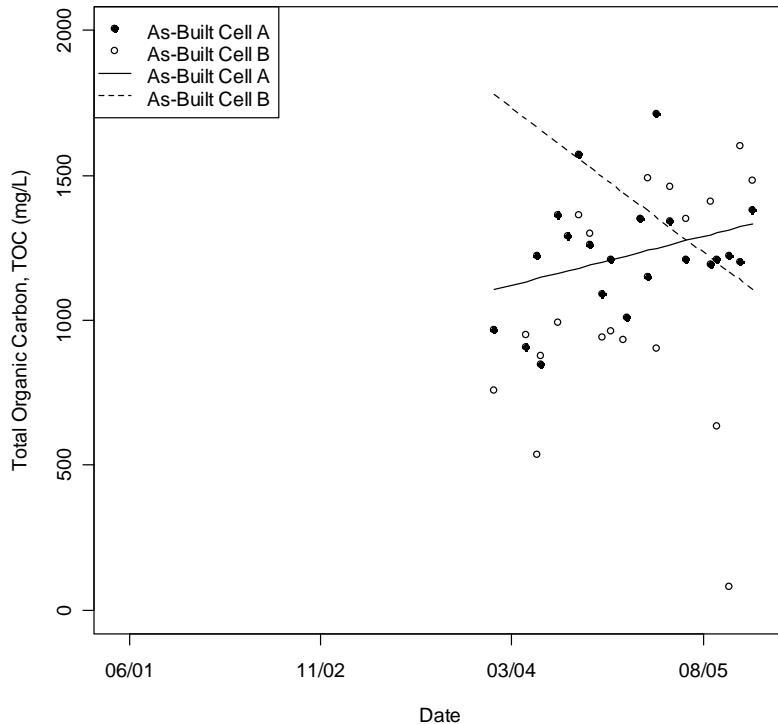
Regression Fits

Landfill Unit	Intercept		Sampling Date		Adjusted-R ²
	Estimate	p-value	Estimate	p-value	
Control cell A	16762.0	0.0002	-1.2791	0.0003	0.4878
Control cell B	-8102.6	0.0359	0.6848	0.0245	0.1991
Retrofit cell A	-251.3	0.9202	0.0473	0.8095	-0.0551
Retrofit cell B	4448.7	0.2190	-0.3200	0.2561	0.0182
As-Built cell A	-3063.4	0.2861	0.3348	0.1410	0.0636
As-Built cell B	14142.8	0.5749	-0.9929	0.6138	-0.0382

Landfill Unit	Intercept		Sampling Date	
	95 % CI Lower	95 % CI Upper	95 % CI Lower	95 % CI Upper
Control cell A	9105.6	24418.4	-1.8770	-0.6812
Control cell B	-15614.1	-591.0	0.0982	1.2715
Retrofit cell A	-5468.7	4966.0	-0.3603	0.4549
Retrofit cell B	-2876.6	11773.9	-0.8921	0.2520
As-Built cell A	-8905.1	2778.4	-0.1214	0.7910
As-Built cell B	-37721.5	66007.2	-5.0433	3.0574

Time plots





Biochemical Oxygen Demand, BOD (mg/L)

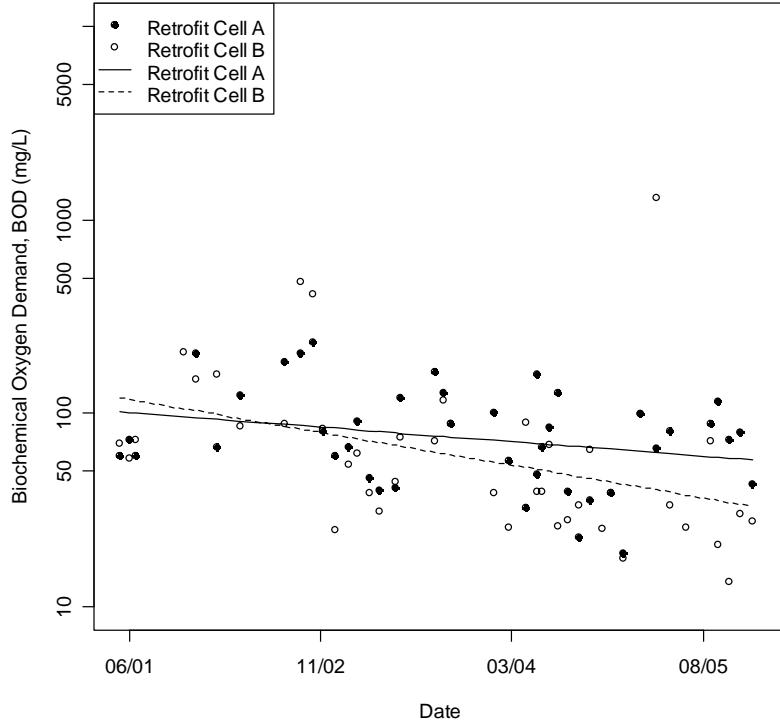
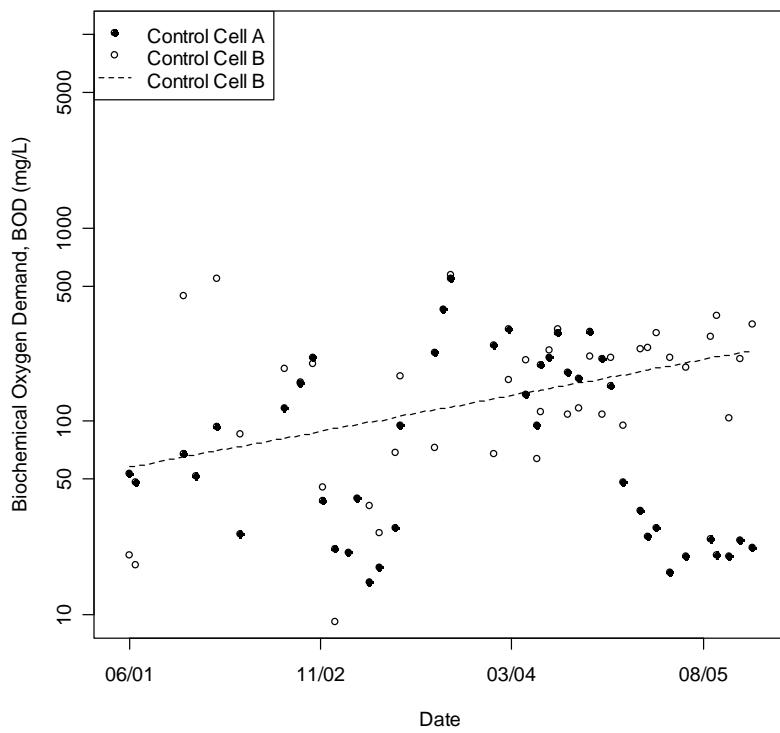
Inspection of the time plots shows large variability for all cells over the sampling period. In addition, most of the residual variances are non-normal and the Control cells and As-Built cells show changing variance over time (note the time plots are in log-scale and the linear fits are for log data) so a linear model is not appropriate. Therefore, looking at the time plots and fits qualitatively, there appears to be an increasing BOD trend in Control cell B and there appear to be decreasing BOD trends in the Retrofit cells and As-Built cells.

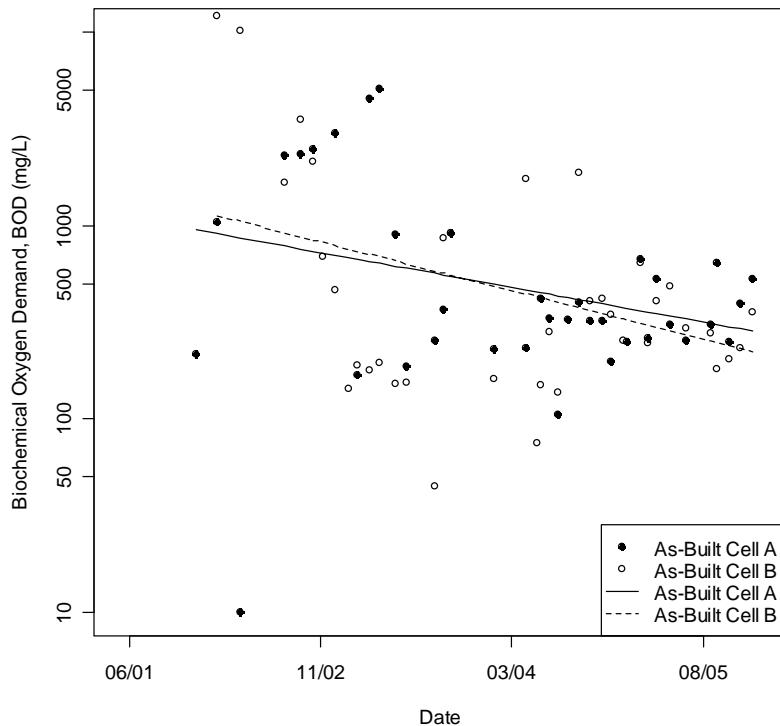
Regression Fits

Landfill Unit	Intercept		Sampling Date		Adjusted-R ²
	Estimate	p-value	Estimate	p-value	
Control cell A	7.18	0.1104	-0.0002	0.5063	-0.0133
Control cell B	-5.73	0.1354	0.0009	0.0076	0.1552
Retrofit cell A	8.58	0.0010	-0.0003	0.0835	0.0511
Retrofit cell B	13.74	0.0002	-0.0008	0.0058	0.1510
As-Built cell A	16.49	0.0109	-0.0008	0.1018	0.0482
As-Built cell B	20.54	0.0042	-0.0012	0.0391	0.0884

Landfill Unit	Intercept		Sampling Date	
	95 % CI Lower	95 % CI Upper	95 % CI Lower	95 % CI Upper
Control cell A	-1.71	16.07	-0.0010	0.0005
Control cell B	-13.33	1.87	0.0002	0.0015
Retrofit cell A	3.71	13.45	-0.0007	0.0000
Retrofit cell B	7.03	20.45	-0.0013	-0.0002
As-Built cell A	4.04	28.93	-0.0018	0.0002
As-Built cell B	6.90	34.18	-0.0022	-0.0001

Time plots





Chemical Oxygen Demand, COD (mg/L)

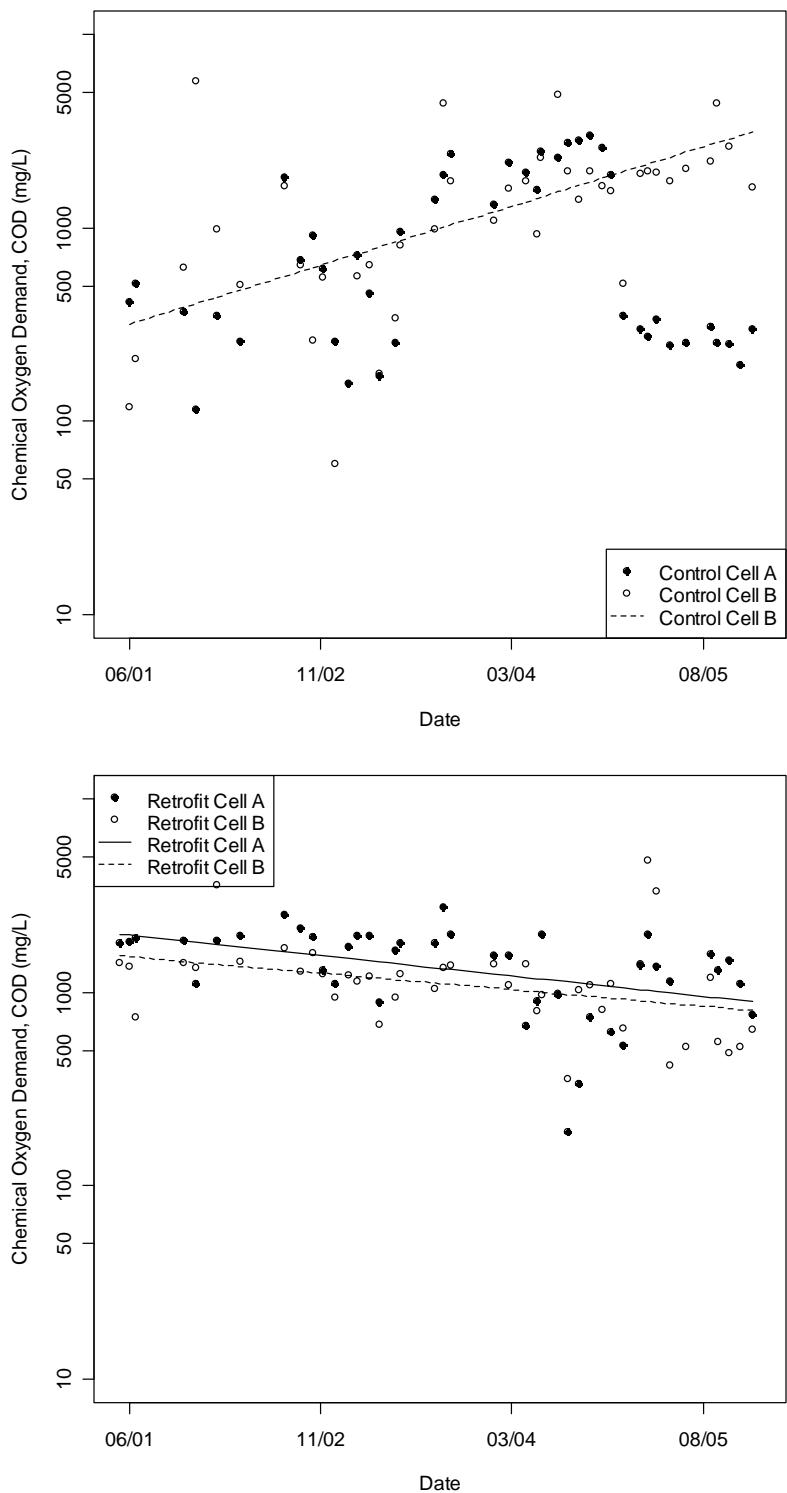
As with BOD, inspection of the COD time plots shows large variability for all cells over the sampling period. In addition, most of the residual variances are non-normal and the Control cells and As-Built cells show changing variance over time (note the time plots are in log-scale and the linear fits are for log data) so a linear model is not appropriate. Therefore, looking at the time plots and fits qualitatively, there appears to be an increasing COD trend in Control cell B and a decreasing COD trend in the Retrofit cells, and no COD trend in the As-Built cells.

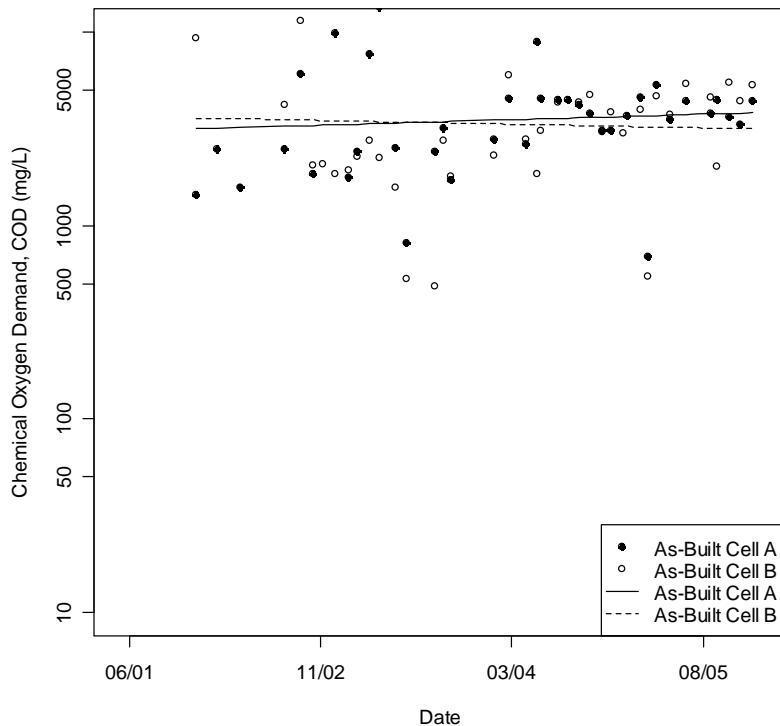
Regression Fits

Landfill Unit	Intercept		Sampling Date		Adjusted-R ²
	Estimate	p-value	Estimate	p-value	
Control cell A	4.66	0.2668	0.0001	0.6654	-0.0202
Control cell B	-10.41	0.0072	0.0014	0.0000	0.3508
Retrofit cell A	13.16	0.0000	-0.0005	0.0048	0.1661
Retrofit cell B	11.83	0.0000	-0.0004	0.0157	0.1132
As-Built cell A	6.53	0.0619	0.0001	0.6326	-0.0206
As-Built cell B	9.20	0.0363	-0.0001	0.8000	-0.0252

Landfill Unit	Intercept		Sampling Date	
	95 % CI Lower	95 % CI Upper	95 % CI Lower	95 % CI Upper
Control cell A	-3.70	13.02	-0.0005	0.0008
Control cell B	-17.84	-2.98	0.0008	0.0020
Retrofit cell A	9.11	17.21	-0.0008	-0.0002
Retrofit cell B	7.95	15.72	-0.0007	-0.0001
As-Built cell A	-0.34	13.40	-0.0004	0.0007
As-Built cell B	0.62	17.78	-0.0008	0.0006

Time plots





BOD/COD Ratio

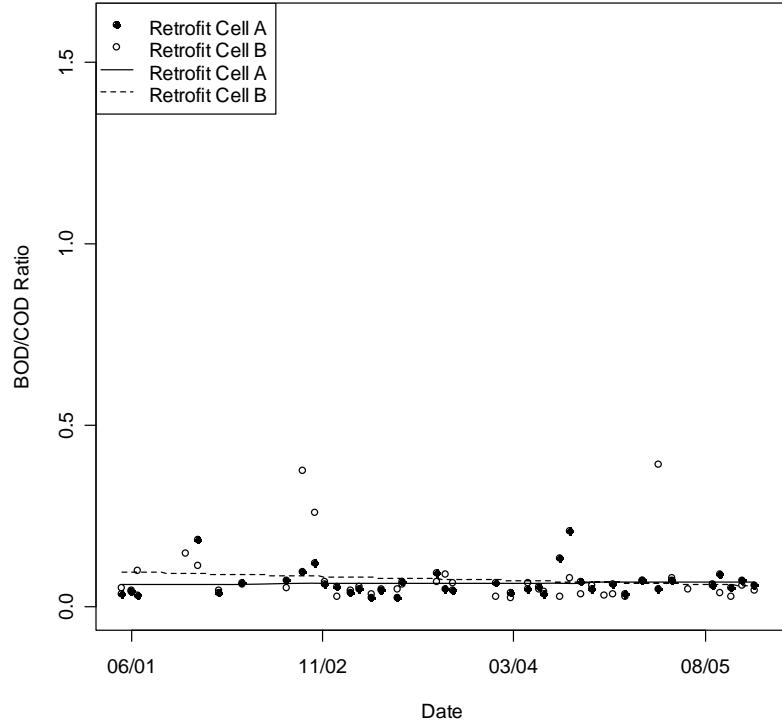
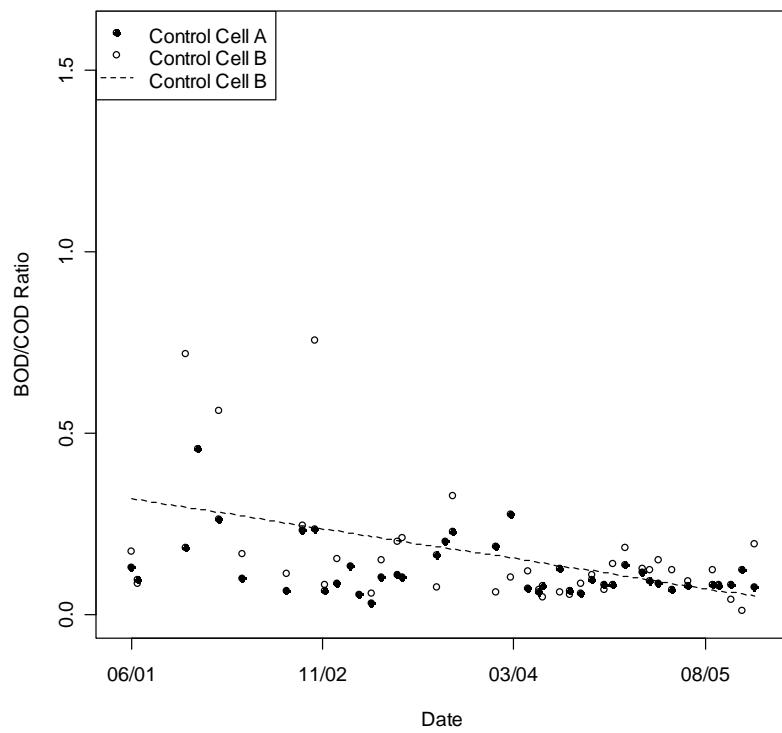
The time plots for the Control cells and As-Built cells indicate that a linear model is not appropriate for the BOD/COD ratio. Qualitatively, both of these cells show trends decreasing to near zero. For the Retrofit cells, the linear model appears appropriate, but is not a good fit. Qualitatively, there is no trend in this Cell as most observations are near zero over the sampling period.

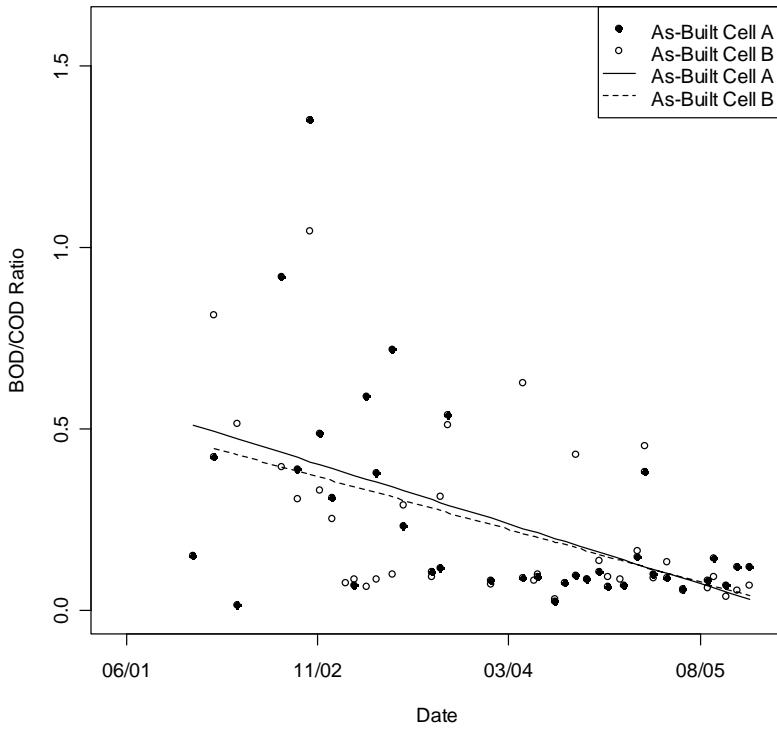
Regression Fits

Landfill Unit	Intercept		Sampling Date		Adjusted-R ²
	Estimate	p-value	Estimate	p-value	
Control cell A	0.97	0.0030	-0.0001	0.0088	0.1384
Control cell B	2.21	0.0016	-0.0002	0.0031	0.1969
Retrofit cell A	0.01	0.9301	0.0000	0.7637	-0.0245
Retrofit cell B	0.35	0.2858	0.0000	0.4014	-0.0069
As-Built cell A	4.37	0.0011	-0.0003	0.0019	0.2288
As-Built cell B	3.85	0.0008	-0.0003	0.0015	0.2378

Landfill Unit	Intercept		Sampling Date	
	95 % CI Lower	95 % CI Upper	95 % CI Lower	95 % CI Upper
Control cell A	0.35	1.59	-0.0001	0.0000
Control cell B	0.90	3.52	-0.0003	-0.0001
Retrofit cell A	-0.32	0.35	0.0000	0.0000
Retrofit cell B	-0.30	0.99	-0.0001	0.0000
As-Built cell A	1.88	6.86	-0.0005	-0.0001
As-Built cell B	1.72	5.99	-0.0005	-0.0001

Time plots





Total Kjeldahl Nitrogen, TKN (mg/L)

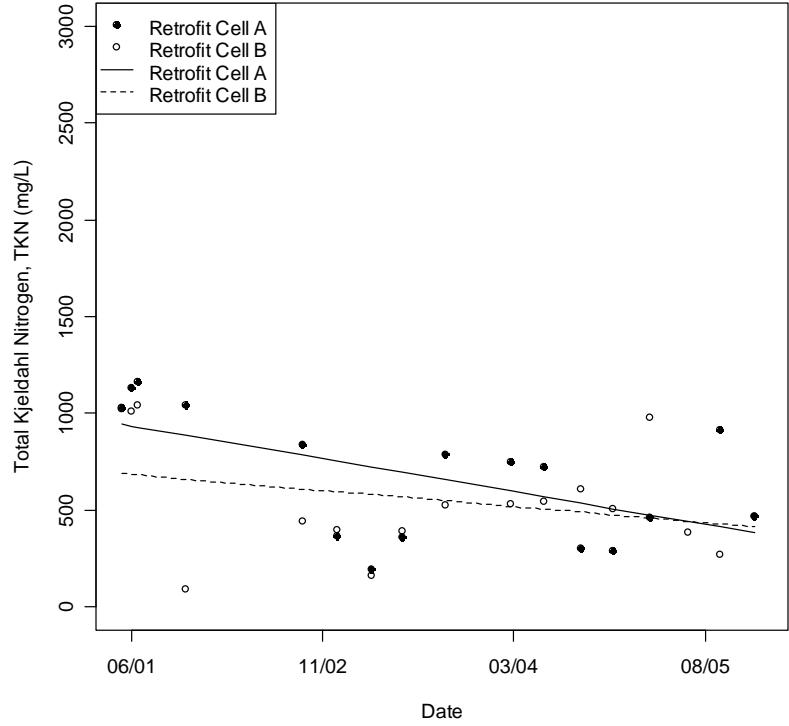
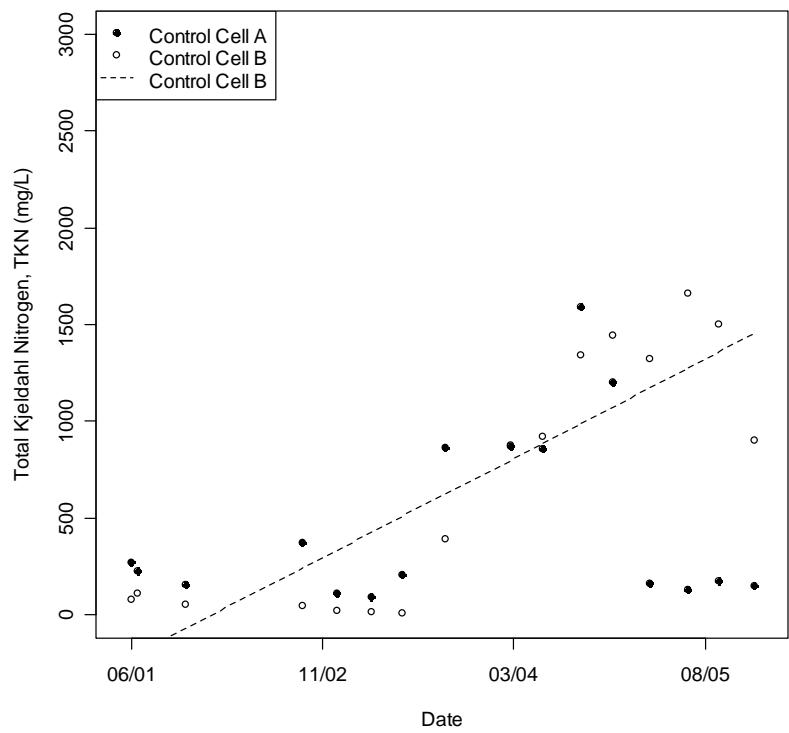
The increasing TKN trends seen in the Control cells and As-Built cells appear to be non-linear. Therefore, a linear model is likely inappropriate. Further sampling appears needed before a proper model can be determined. However, using a linear model as an approximation shows good regression fits and significant increasing trends. A linear model appears appropriate in the Retrofit cells, but the fit is not very good. In Retrofit cell A, there is a significant decreasing TKN trend while there is no TKN trend in Retrofit cell B. Inspection of the diagnostic plots for the Retrofit cells indicates the linear model assumptions are met adequately.

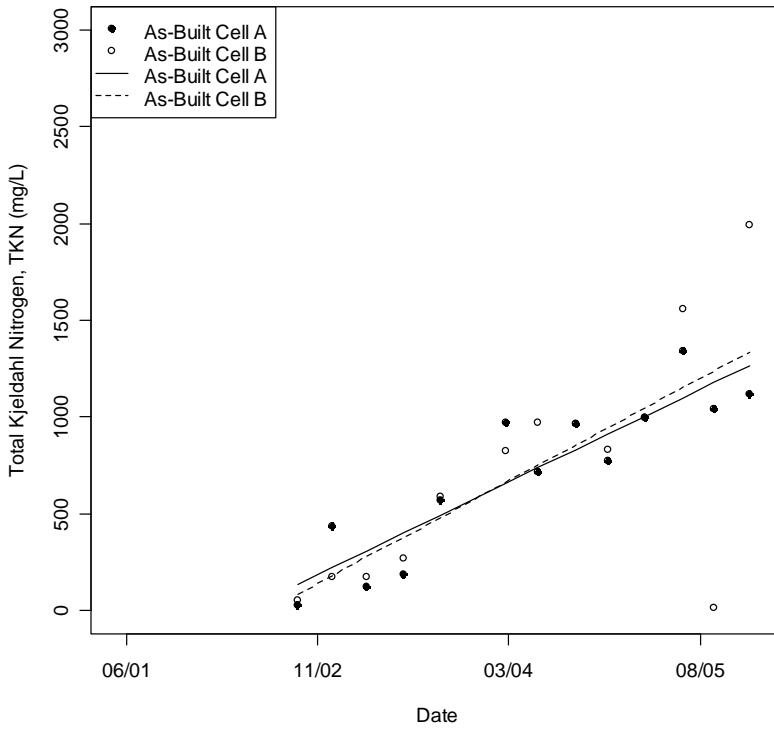
Regression Fits

Landfill Unit	Intercept		Sampling Date		Adjusted-R ²
	Estimate	p-value	Estimate	p-value	
Control cell A	-1978.8	0.4883	0.1975	0.3943	-0.0154
Control cell B	-12010.8	0.0000	1.0255	0.0000	0.7234
Retrofit cell A	4823.3	0.0093	-0.3383	0.0212	0.2764
Retrofit cell B	2583.4	0.1259	-0.1653	0.2209	0.0380
As-Built cell A	-11284.1	0.0000	0.9558	0.0000	0.8011
As-Built cell B	-12526.3	0.0117	1.0557	0.0086	0.4335

Landfill Unit	Intercept		Sampling Date	
	95 % CI Lower	95 % CI Upper	95 % CI Lower	95 % CI Upper
Control cell A	-7942.0	3984.5	-0.2845	0.6795
Control cell B	-16301.6	-7720.1	0.6787	1.3723
Retrofit cell A	1388.7	8257.9	-0.6180	-0.0586
Retrofit cell B	-814.5	5981.4	-0.4410	0.1105
As-Built cell A	-15044.3	-7523.8	0.6563	1.2553
As-Built cell B	-21668.3	-3384.2	0.3275	1.7839

Time plots





Ammonia as Nitrogen (mg/L)

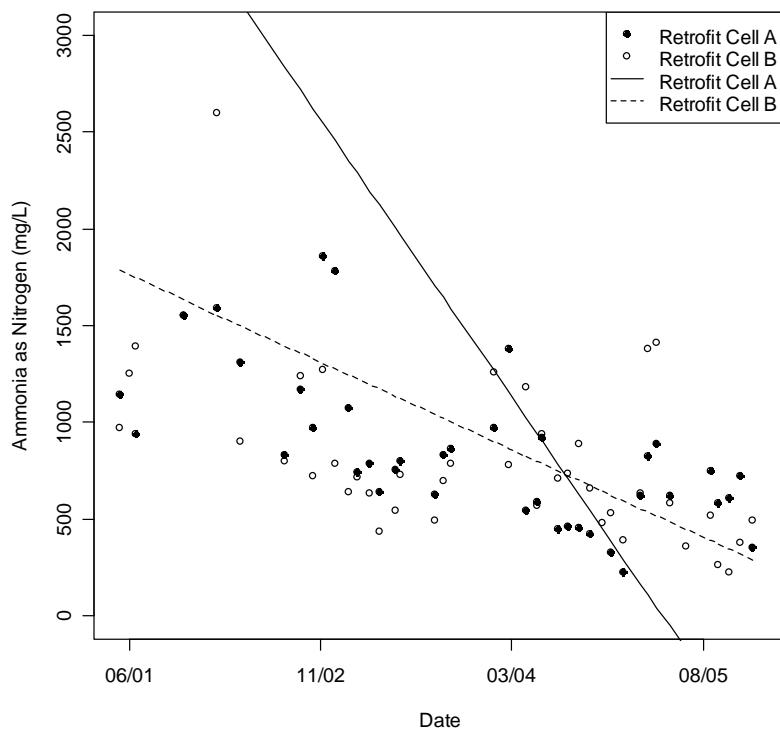
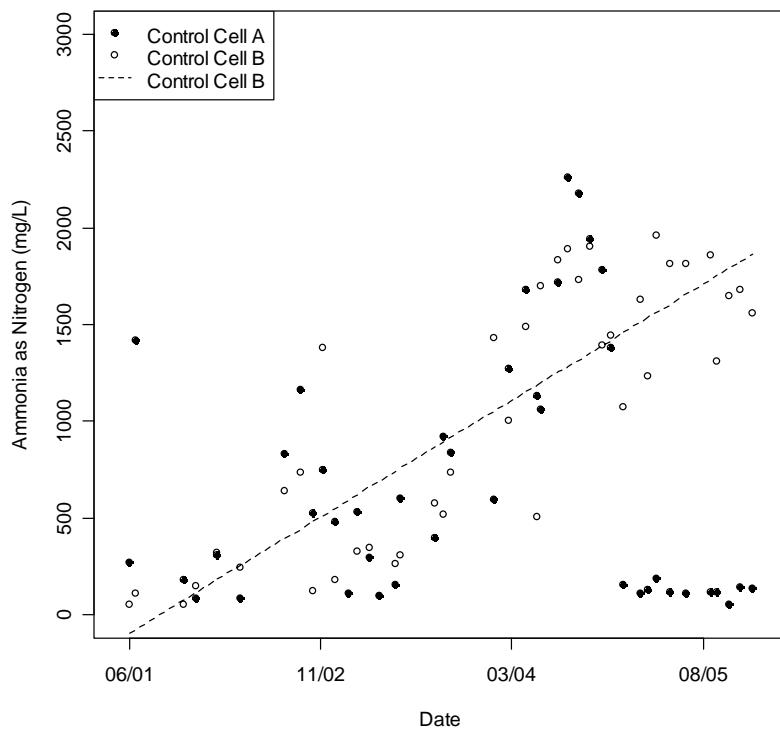
While there is large variability in all cells over the sampling period, a linear model appears appropriate. However, there are several influential values that should be investigated, e.g., the samples larger than 10,000 mg/L in Retrofit cell A. While the fits are only modest in quality, there are significant increasing trends in the Control and As-Built cells, and significant decreasing trends in the Retrofit cells. Inspection of the diagnostic plots indicates the linear regression assumptions are met adequately except for the influential values that should be investigated further.

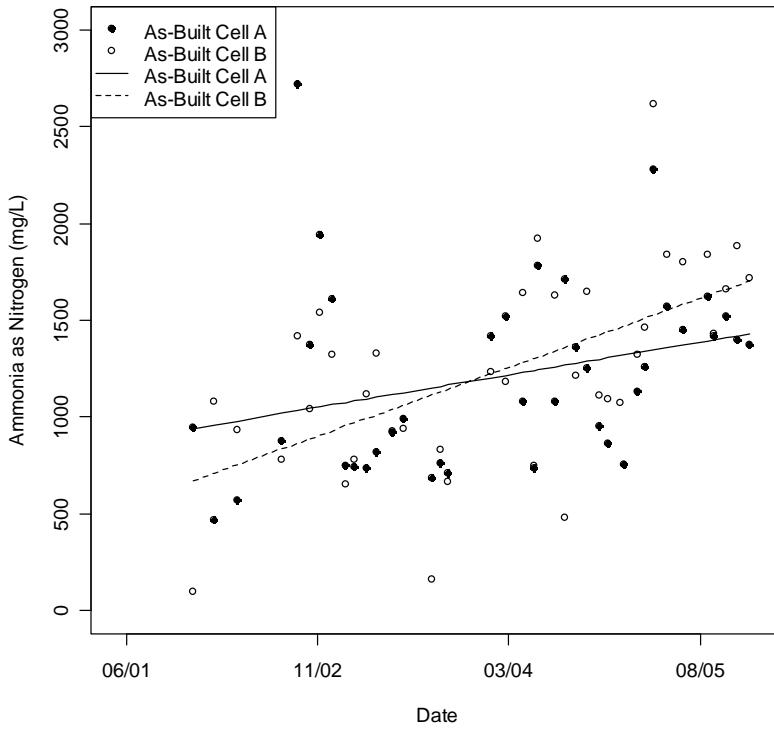
Regression Fits

Landfill Unit	Intercept		Sampling Date		Adjusted-R ²
	Estimate	p-value	Estimate	p-value	
Control cell A	29.0	0.9916	0.0521	0.8142	-0.0236
Control cell B	-13904.5	0.0000	1.2010	0.0000	0.6959
Retrofit cell A	36951.3	0.0037	-2.8657	0.0052	0.1623
Retrofit cell B	12158.4	0.0023	-0.9041	0.0047	0.1592
As-Built cell A	-2987.6	0.1939	0.3365	0.0710	0.0607
As-Built cell B	-7616.1	0.0006	0.7098	0.0001	0.3242

Landfill Unit	Intercept		Sampling Date	
	95 % CI Lower	95 % CI Upper	95 % CI Lower	95 % CI Upper
Control cell A	-5495.2	5553.2	-0.3930	0.4972
Control cell B	-17040.7	-10768.3	0.9484	1.4535
Retrofit cell A	12716.6	61186.1	-4.8253	-0.9062
Retrofit cell B	4596.8	19720.0	-1.5144	-0.2938
As-Built cell A	-7563.1	1587.8	-0.0303	0.7032
As-Built cell B	-11707.4	-3524.7	0.3819	1.0378

Time plots





Total Iron (mg/L)

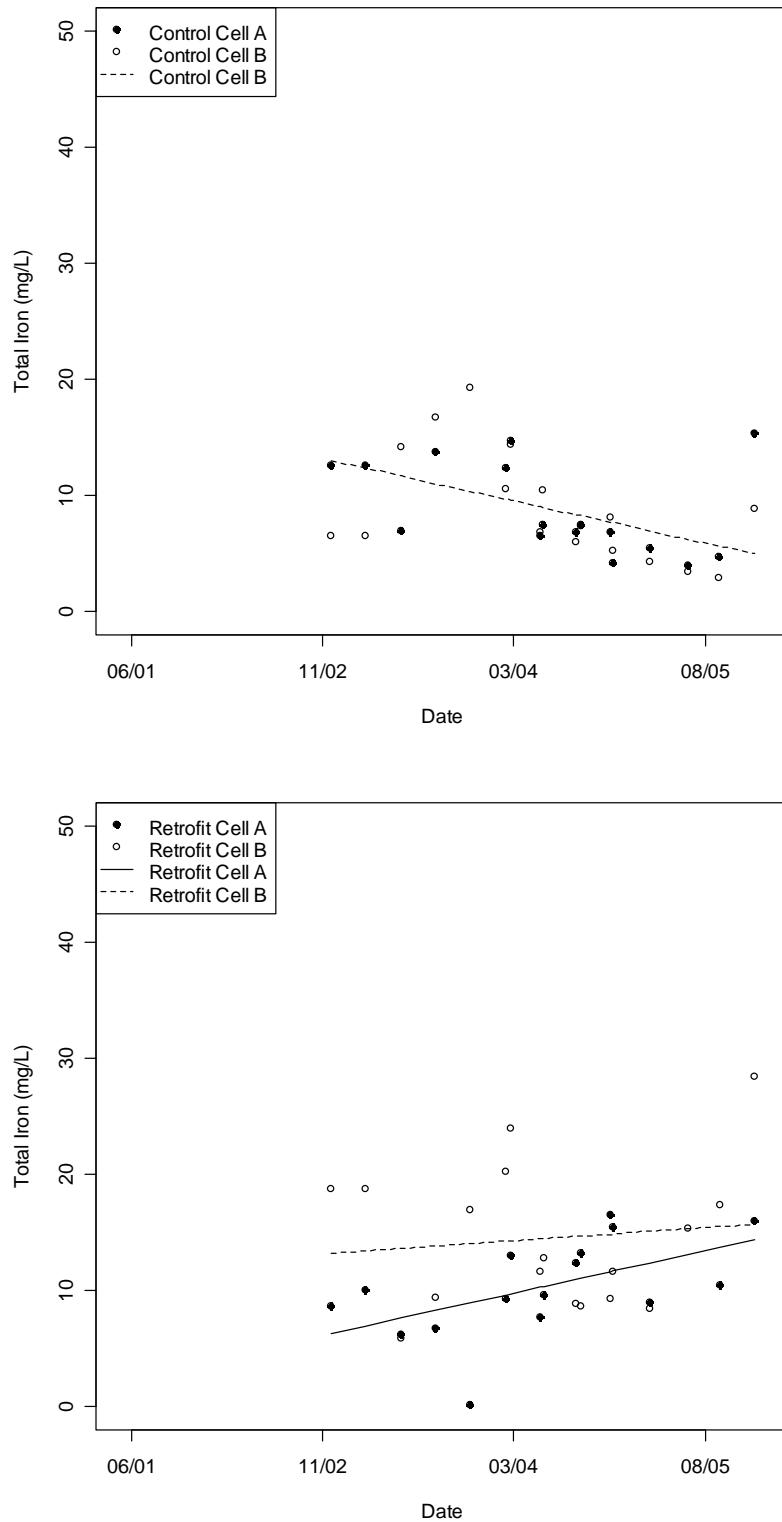
The time plots indicate a linear model is not appropriate in the Control or the As-Built cells. Qualitatively speaking, iron concentrations in these cells are decreasing over time. The time plot for Retrofit cell A indicates a linear model may be appropriate. The coefficient for sampling date is significant and shows an increasing trend with time. The diagnostic plots indicate the linear regression assumptions are adequately met. The time plot for Retrofit cell B also indicates a linear model might be appropriate. The coefficient for sampling date is not significant here indicating no significant trend. The diagnostic plots indicate the linear regression assumptions are met adequately except for the large influence of the final sample. Removing the final sample would not change the trend in iron concentrations.

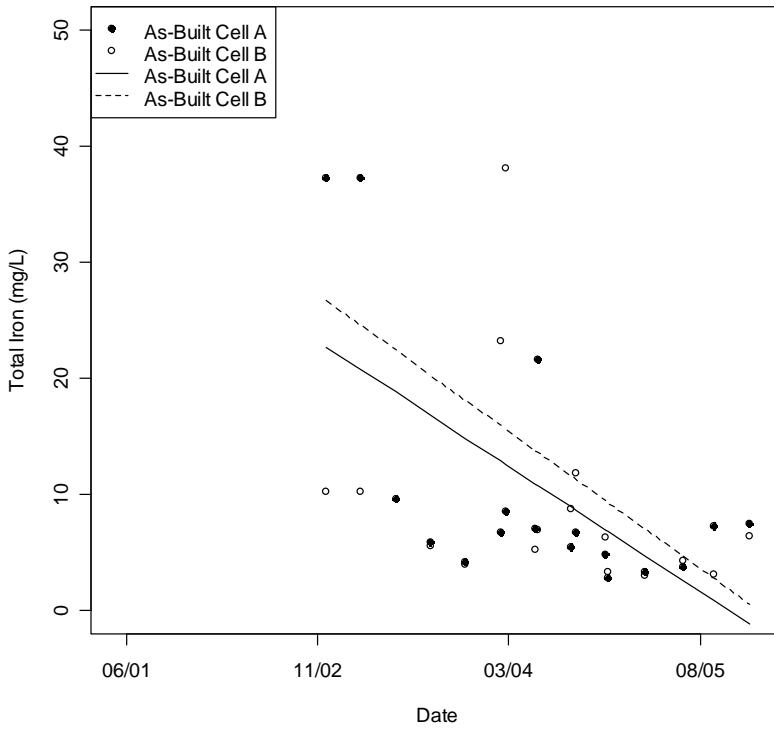
Regression Fits

Landfill Unit	Intercept		Sampling Date		Adjusted-R ²
	Estimate	p-value	Estimate	p-value	
Control cell A	269.8	0.3843	-0.0202	0.4125	-0.0184
Control cell B	100.1	0.0324	-0.0072	0.0483	0.1845
Retrofit cell A	-81.4	0.0494	0.0073	0.0296	0.2450
Retrofit cell B	-14.1	0.8264	0.0023	0.6573	-0.0523
As-Built cell A	281.9	0.0053	-0.0216	0.0067	0.3564
As-Built cell B	310.5	0.0962	-0.0236	0.1100	0.1055

Landfill Unit	Intercept		Sampling Date	
	95 % CI Lower	95 % CI Upper	95 % CI Lower	95 % CI Upper
Control cell A	-371.9	911.4	-0.0711	0.0308
Control cell B	9.6	190.6	-0.0144	-0.0001
Retrofit cell A	-162.6	-0.2	0.0008	0.0138
Retrofit cell B	-148.4	120.3	-0.0084	0.0129
As-Built cell A	97.6	466.1	-0.0362	-0.0069
As-Built cell B	-62.4	683.4	-0.0532	0.0060

Time plots





Ortho-Phosphate (mg/L)

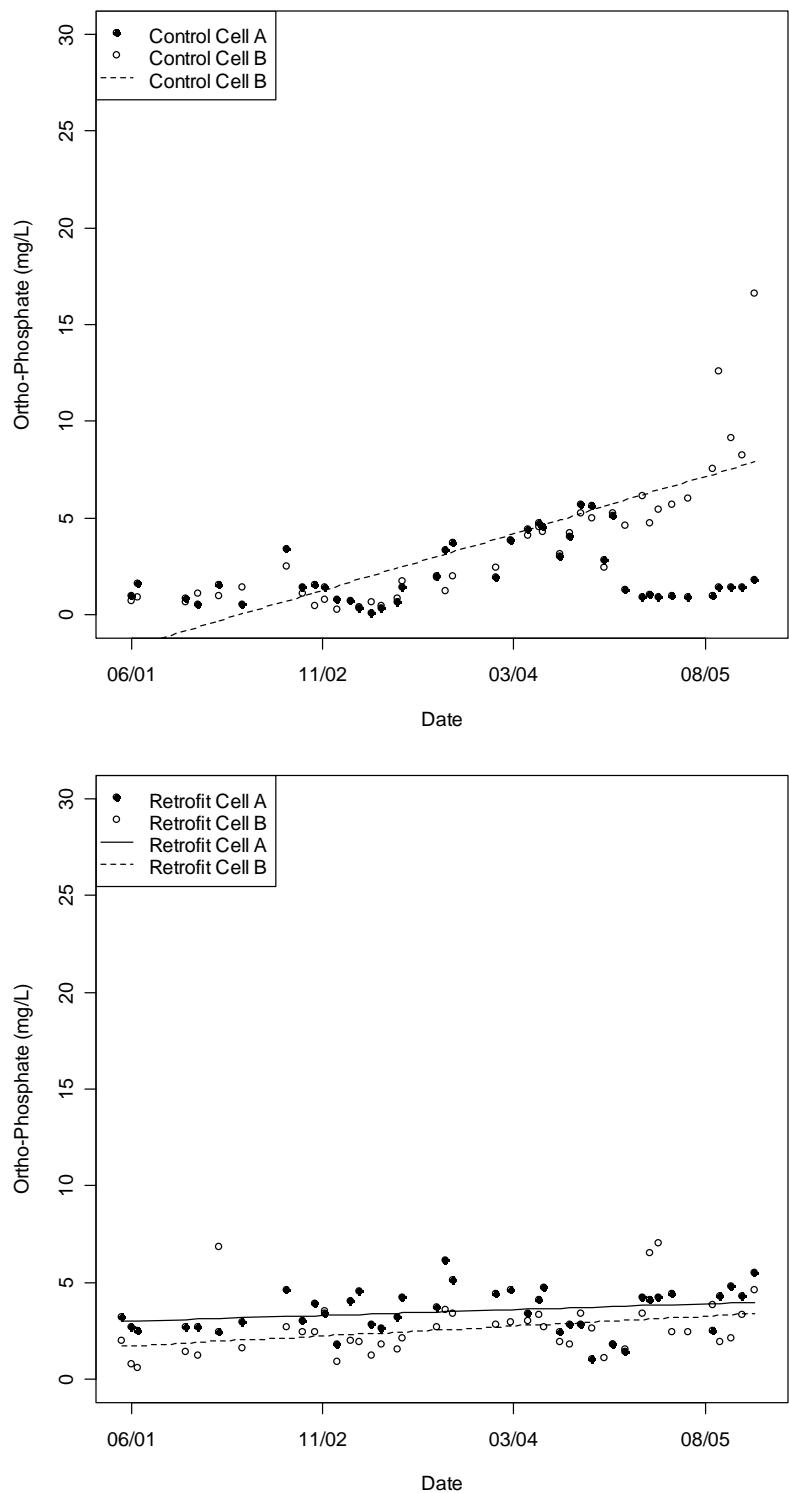
The increasing trends seen in the Control cells and As-Built cells appear to be non-linear. Therefore, a linear model is likely inappropriate. Further sampling appears needed before a proper model can be determined. However, using a linear model as an approximation shows good regression fits and significant increasing trends in the Control and As-Built cells. A linear model appears appropriate in the Retrofit cells, but the fit is not very good. The trend in both Retrofit cells is slightly increasing. Inspection of the diagnostic plots for the Retrofit cells indicates the linear model assumptions are met adequately, except for the slightly influential large concentrations in Retrofit cell B.

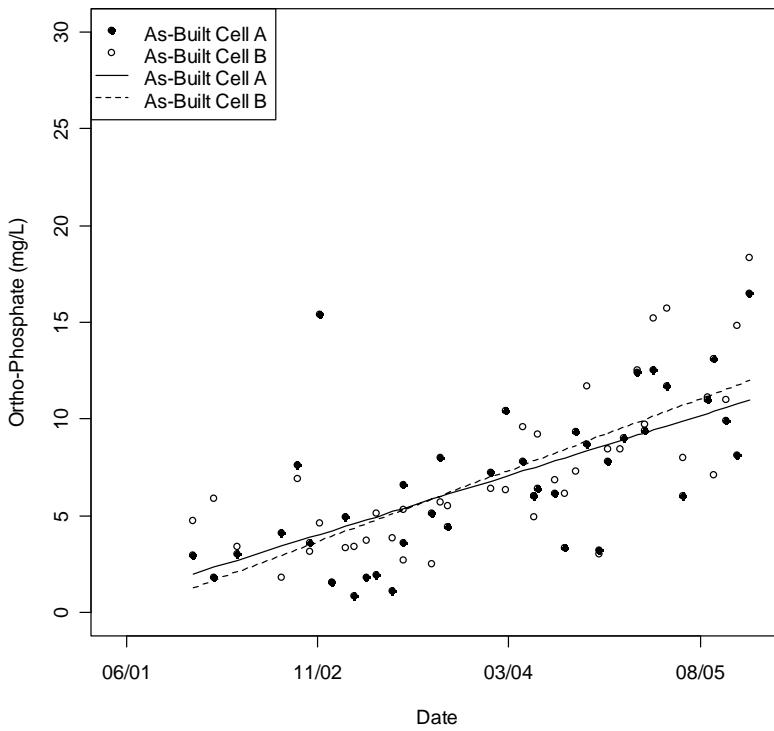
Regression Fits

Landfill Unit	Intercept		Sampling Date		Adjusted-R ²
	Estimate	p-value	Estimate	p-value	
Control cell A	-8.46	0.1916	0.0008	0.1072	0.0402
Control cell B	-68.99	0.0000	0.0059	0.0000	0.6313
Retrofit cell A	-3.95	0.3808	0.0006	0.1019	0.0432
Retrofit cell B	-10.05	0.0723	0.0010	0.0250	0.0951
As-Built cell A	-69.93	0.0000	0.0062	0.0000	0.3940
As-Built cell B	-84.93	0.0000	0.0074	0.0000	0.5527

Landfill Unit	Intercept		Sampling Date	
	95 % CI Lower	95 % CI Upper	95 % CI Lower	95 % CI Upper
Control cell A	-21.34	4.42	-0.0002	0.0019
Control cell B	-86.64	-51.35	0.0044	0.0073
Retrofit cell A	-12.95	5.06	-0.0001	0.0013
Retrofit cell B	-21.05	0.95	0.0001	0.0019
As-Built cell A	-100.22	-39.64	0.0037	0.0086
As-Built cell B	-111.15	-58.71	0.0053	0.0095

Time plots





Total Phosphorus (mg/L)

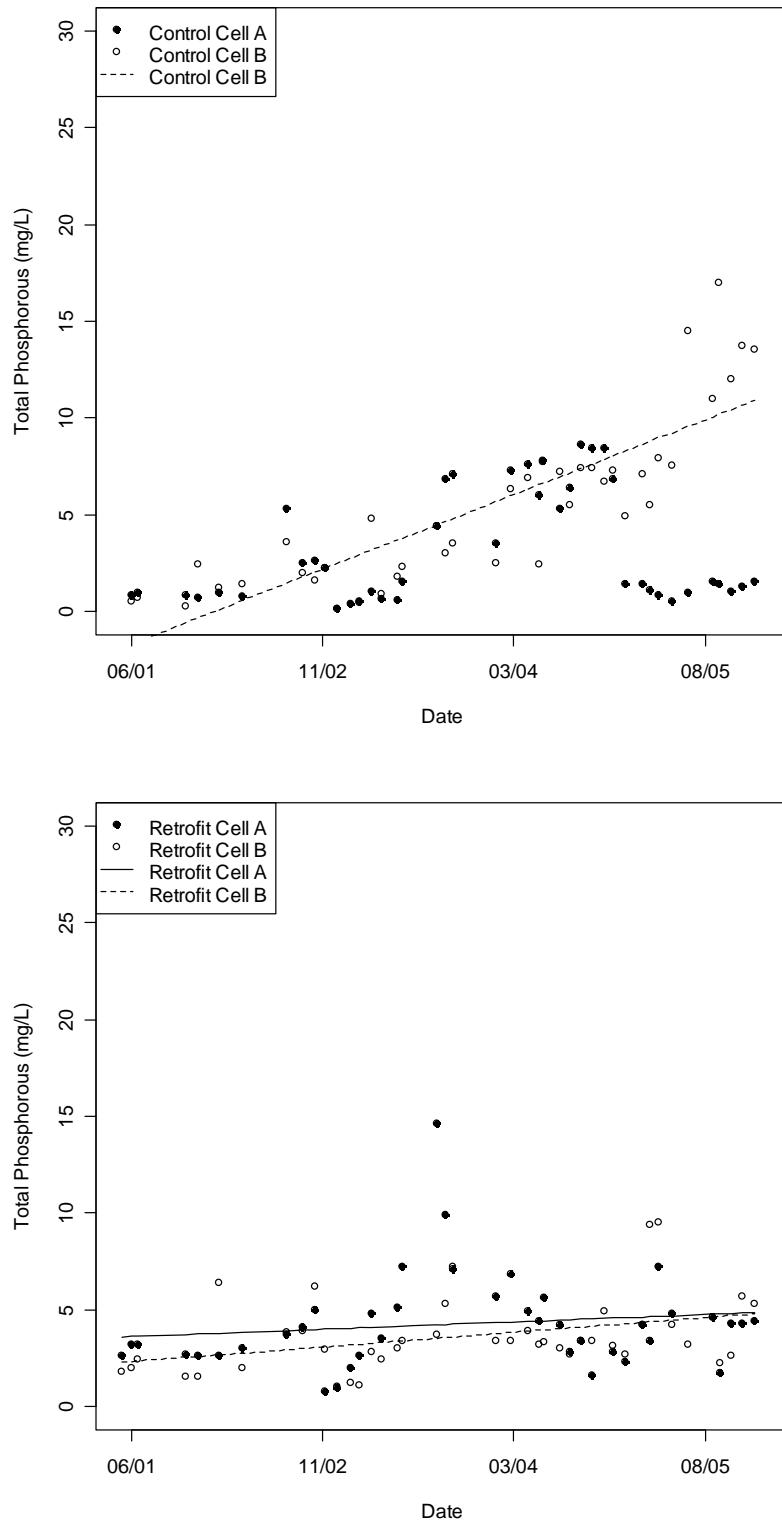
The increasing trend in Control cell B appears to be non-linear. None the less, using the linear model as an approximation provides a good fit and indicates an increasing trend. The time plot for Retrofit cell A indicates a spike in concentrations around September 2003. Thus, a linear model is not appropriate. In a qualitative sense, the time plot indicates no trend to a slightly increasing trend. The diagnostic plots for Retrofit cell B indicate the linear model assumptions are adequately met. While the fit is not great, there is a slightly increasing significant trend. The diagnostic plots for the As-Built cells indicate the linear regression assumptions are met and the fits are moderate. Therefore, there are significant increasing trends in the As-Built cells.

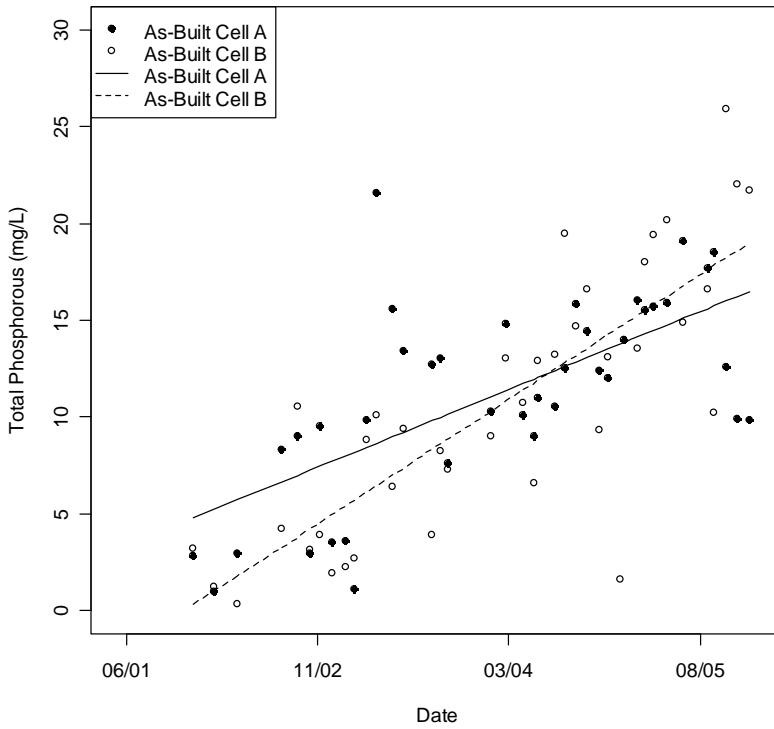
Regression Fits

Landfill Unit	Intercept		Sampling Date		Adjusted-R ²
	Estimate	p-value	Estimate	p-value	
Control cell A	-13.59	0.2505	0.0013	0.1599	0.0250
Control cell B	-90.41	0.0000	0.0077	0.0000	0.7126
Retrofit cell A	-5.08	0.6143	0.0008	0.3556	-0.0032
Retrofit cell B	-15.16	0.0381	0.0015	0.0111	0.1264
As-Built cell A	-88.93	0.0000	0.0080	0.0000	0.4143
As-Built cell B	-149.98	0.0000	0.0129	0.0000	0.6417

Landfill Unit	Intercept		Sampling Date	
	95 % CI Lower	95 % CI Upper	95 % CI Lower	95 % CI Upper
Control cell A	-37.13	9.96	-0.0006	0.0032
Control cell B	-109.77	-71.04	0.0062	0.0093
Retrofit cell A	-25.29	15.14	-0.0009	0.0024
Retrofit cell B	-29.45	-0.87	0.0004	0.0027
As-Built cell A	-127.36	-50.50	0.0049	0.0111
As-Built cell B	-189.13	-110.82	0.0097	0.0160

Time plots





Chloride (mg/L)

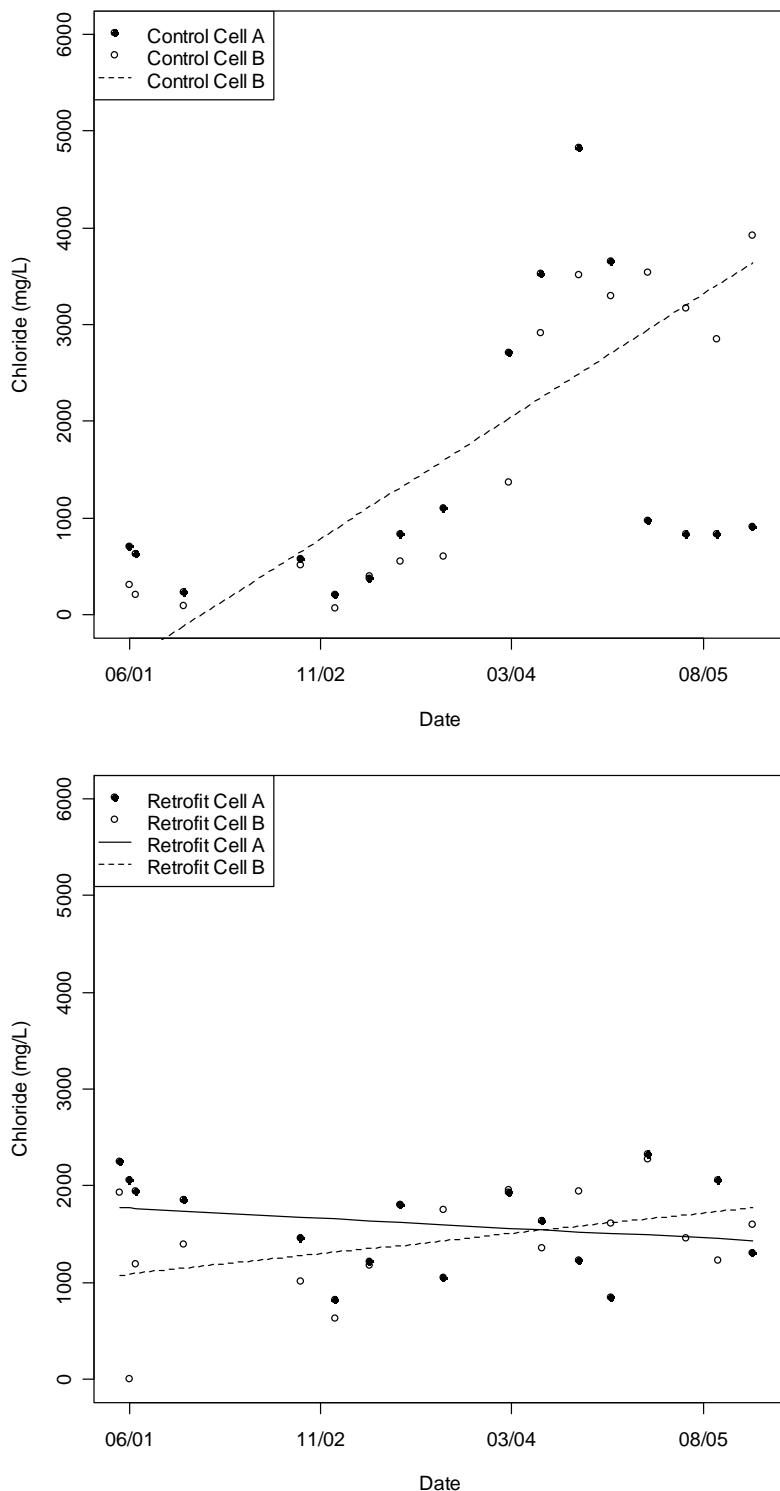
The diagnostic plots for all cells indicate the linear regression assumptions are met adequately and the regression fits are moderate. Therefore, there are significant increasing trends in the Control and As-Built cells and no trend in the Retrofit cells.

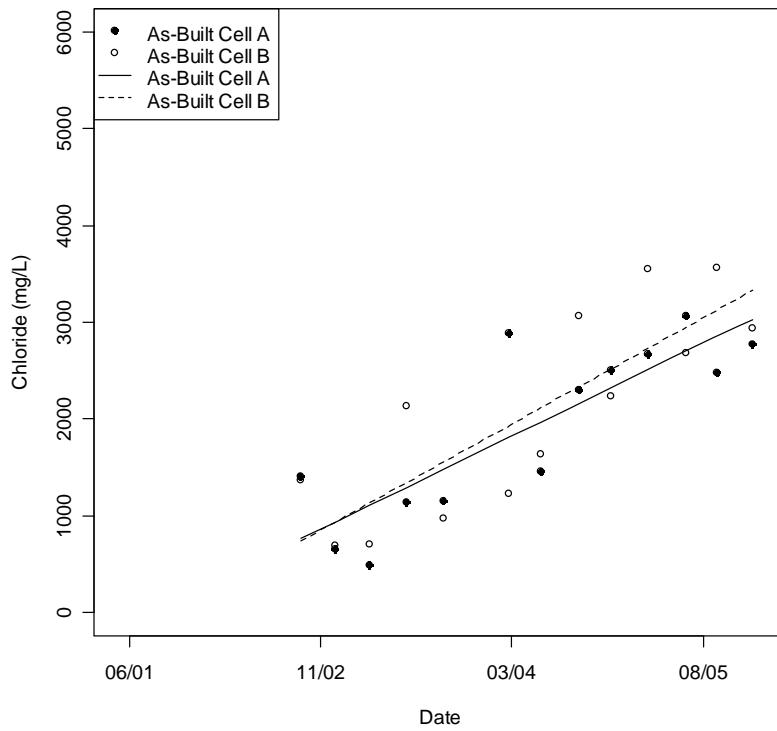
Regression Fits

Landfill Unit	Intercept		Sampling Date		Adjusted-R ²
	Estimate	p-value	Estimate	p-value	
Control cell A	-11312.4	0.1817	1.0307	0.1355	0.0914
Control cell B	-29495.8	0.0000	2.5240	0.0000	0.7854
Retrofit cell A	4173.2	0.1592	-0.2090	0.3761	-0.0111
Retrofit cell B	-3787.9	0.1965	0.4237	0.0822	0.1338
As-Built cell A	-22139.9	0.0006	1.9171	0.0003	0.6790
As-Built cell B	-25429.4	0.0008	2.1902	0.0004	0.6608

Landfill Unit	Intercept		Sampling Date	
	95 % CI Lower	95 % CI Upper	95 % CI Lower	95 % CI Upper
Control cell A	-28578.1	5953.4	-0.3649	2.4262
Control cell B	-38452.9	-20538.6	1.8000	3.2479
Retrofit cell A	-1846.4	10192.9	-0.6991	0.2812
Retrofit cell B	-9760.4	2184.6	-0.0611	0.9084
As-Built cell A	-32453.1	-11826.7	1.0957	2.7386
As-Built cell B	-37687.0	-13171.9	1.2139	3.1665

Time plots





Summary of Influential Points in Regression Analysis of Trends in the As-Built cells, Retrofit cells and Control cell B.

Parameter	Landfill Unit	Sample Date	Result	Detection Limit
Temperature (°C)	As-Built cell A	12/18/2001	19.8	0
	As-Built cell A	12/13/2005	31.5	0
	As-Built cell B	12/18/2001	15.3	0
	As-Built cell B	2/11/2002	18.2	0
	As-Built cell B	9/16/2002	33.8	0
	As-Built cell B	8/18/2004	28.4	0
	Control cell B	12/16/2002	6.8	0
	Control cell B	11/16/2004	14	0
	Control cell B	1/10/2005	13.4	0
pH (-log H ⁺)	As-Built cell A	11/14/2002	6.31	0
	As-Built cell B	12/18/2001	5.89	0
	As-Built cell B	8/18/2004	6.01	1
	As-Built cell B	9/2/2004	5.2	1
	Control cell B	12/16/2002	6.43	0
	Control cell B	4/10/2003	6.28	0
	Retrofit cell A	10/16/2003	7.61	0
Acetic Acid (mg/L)	As-Built cell A	12/16/2002	1012	1
	As-Built cell A	3/18/2003	1173	1
	As-Built cell A	4/10/2003	1654	20
	As-Built cell B	2/11/2002	2580	1
	As-Built cell B	9/16/2002	1206	1
	As-Built cell B	3/15/2004	1028	1
	As-Built cell B	8/18/2004	1040	1

Parameter	Landfill Unit	Sample Date	Result	Detection Limit
	Control cell B	12/18/2001	1010	5
	Retrofit cell A	11/14/2002	2353	1
	Retrofit cell B	4/12/2002	2340	20
Propionic Acid (mg/L)	As-Built cell A	9/16/2002	854	1
	As-Built cell A	3/18/2003	865	1
	As-Built cell A	4/10/2003	1664	20
	As-Built cell B	2/11/2002	1984	1
	As-Built cell B	9/16/2002	1489	1
	As-Built cell B	8/18/2004	1568	1
	Control cell B	12/18/2001	395	5
	Control cell B	9/25/2003	268	1
	Retrofit cell A	11/14/2002	3149	1
	Retrofit cell B	4/12/2002	2778	20
TOC (mg/L)	As-Built cell A	6/8/2004	848	20
	As-Built cell A	9/14/2004	1570	50
	As-Built cell A	4/7/2005	1710	40
	As-Built cell B	5/28/2004	537	10
	As-Built cell B	8/18/2004	8670	200
	As-Built cell B	9/12/2005	633	20
	As-Built cell B	10/14/2005	81.3	40
	Control cell B	9/12/2005	1690	20
	Retrofit cell B	4/7/2005	1260	40
BOD (mg/L)	As-Built cell A	4/11/2002	20	20
	As-Built cell A	11/14/2002	15000	20
	As-Built cell B	2/11/2002	12100	200
	As-Built cell B	4/11/2002	10100	200
	As-Built cell B	9/2/2004	25300	1000
	Control cell B	11/15/2001	444	20
	Control cell B	2/11/2002	548	2
	Control cell B	12/16/2002	9.2	2
	Retrofit cell B	9/16/2002	480	2
	Retrofit cell B	10/21/2002	411	2
	Retrofit cell B	4/7/2005	1290	20
COD (mg/L)	As-Built cell A	11/14/2002	30900	400
	As-Built cell A	6/20/2003	805	10
	As-Built cell A	3/15/2005	689	50
	As-Built cell B	2/11/2002	14900	250
	As-Built cell B	4/11/2002	19600	400
	As-Built cell B	6/20/2003	532	10
	As-Built cell B	9/4/2003	486	20
	As-Built cell B	8/18/2004	35000	400
	Control cell B	12/18/2001	5720	100
	Control cell B	12/16/2002	60.3	10
	Control cell B	11/10/2005	20000	400
	Retrofit cell A	8/18/2004	189	100
	Retrofit cell A	9/14/2004	335	50
	Retrofit cell B	8/18/2004	358	100

Parameter	Landfill Unit	Sample Date	Result	Detection Limit
	Retrofit cell B	3/15/2005	4820	50
	Retrofit cell B	4/7/2005	3310	50
BOD/COD Ratio	As-Built cell A	4/11/2002	0.012658228	NA
	As-Built cell A	8/7/2002	0.919678715	NA
	As-Built cell A	10/21/2002	1.35326087	NA
	As-Built cell B	10/21/2002	1.044117647	NA
	As-Built cell B	4/29/2004	0.625	NA
	Control cell B	11/15/2001	0.718446602	NA
	Control cell B	2/11/2002	0.562628337	NA
	Control cell B	10/21/2002	0.755725191	NA
	Retrofit cell A	12/17/2001	0.183783784	NA
	Retrofit cell A	8/18/2004	0.208465608	NA
	Retrofit cell B	9/16/2002	0.375	NA
	Retrofit cell B	10/21/2002	0.258490566	NA
	Retrofit cell B	4/7/2005	0.389728097	NA
TKN (mg/L)	As-Built cell B	6/23/2005	1560	25
	As-Built cell B	9/12/2005	9.4	0.1
	As-Built cell B	12/13/2005	1990	20
	Control cell B	12/13/2005	897	20
	Retrofit cell A	9/13/2005	910	12.1
	Retrofit cell B	11/15/2001	89.2	2
	Retrofit cell B	3/15/2005	978	10
Ammonia – Nitrogen (mg/L)	As-Built cell A	9/16/2002	2720	40
	As-Built cell A	4/7/2005	2280	40
	As-Built cell B	12/18/2001	97.3	2
	As-Built cell B	9/4/2003	159	10
	As-Built cell B	8/18/2004	480	20
	As-Built cell B	4/7/2005	2620	40
	Retrofit cell A	6/25/2001	19200	200
	Retrofit cell A	12/17/2001	10900	200
	Retrofit cell B	12/17/2001	7010	200
	Retrofit cell B	2/11/2002	2600	40
Total Iron (mg/L)	As-Built cell A	12/1/2002	37.2	0.05
	As-Built cell A	3/1/2003	37.2	0.05
	As-Built cell A	6/8/2004	21.6	0.05
	As-Built cell B	6/1/2003	77.2	0.05
	As-Built cell B	3/1/2004	23.2	0.05
	As-Built cell B	3/15/2004	38.1	0.05
	Control cell A	12/1/2003	132	0.05
	Retrofit cell A	12/1/2003	0.05	0.05
Ortho Phosphate (mg/L)	As-Built cell A	11/14/2002	15.4	0.4
	Control cell B	9/12/2005	12.6	0.5
	Control cell B	12/13/2005	16.6	0.4
	Retrofit cell B	2/11/2002	6.8	0.5
	Retrofit cell B	3/15/2005	6.5	0.4
	Retrofit cell B	4/7/2005	7	0.2
Total	As-Built cell A	4/10/2003	21.6	0.5

Parameter	Landfill Unit	Sample Date	Result	Detection Limit
Phosphorous (mg/L)	As-Built cell B	1/10/2005	1.6	0.2
	Retrofit cell A	9/4/2003	14.6	0.5
	Retrofit cell B	3/15/2005	9.4	0.1
	Retrofit cell B	4/7/2005	9.5	0.2
Chloride (mg/L)	Retrofit cell B	6/26/2001	10	10

Summary of Leachate Temperature in the Control, Retrofit and As-Built cells (mg/L)

Landfill Unit	N	Percentage Detection	Range (Min-Max)	Mean ± Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
As-Built cell A	39	100	19.8 - 38.7	33.3 ± 3.9	34.4	36.1	37.5
As-Built cell B	40	100	15.3 - 38.8	32.2 ± 5.6	33.5	36.4	38.4
Control cell A	41	100	9.5 - 28.1	20.6 ± 5.2	21.9	24.0	27.7
Control cell B	40	100	6.8 - 31.3	22.1 ± 6.3	23.6	26.4	30.7
Retrofit cell A	41	100	20.8 - 34.6	27.6 ± 3.5	28.6	30.1	33.7
Retrofit cell B	43	100	20.7 - 31.1	26.4 ± 2.4	27.0	28.1	29.7

Notes:

1. The range, mean, and standard deviation are for detects only.
2. N = number of samples.
3. UCL = upper confidence level.
4. The 95 percent UCL, 75th percentile, and 95th percentile were computed for detected constituents; one-half of the reporting limit was substituted in the calculation of these statistics for non-detected constituents.

Summary of Leachate pH in the Control, Retrofit and As-Built cells

Landfill Unit	N	Percentage Detection	Range (Min-Max)	Mean ± Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
As-Built cell A	38	100	6.3 - 7.7	7.3 ± 0.3	7.4	7.5	7.6
As-Built cell B	39	100	5.2 - 7.7	7.3 ± 0.5	7.4	7.5	7.7
Control cell A	39	100	6.4 - 7.6	7 ± 0.3	7.1	7.3	7.5
Control cell B	38	100	6.3 - 7.7	7.1 ± 0.4	7.2	7.4	7.5
Retrofit cell A	41	100	6.8 - 7.6	7.2 ± 0.2	7.2	7.3	7.4
Retrofit cell B	43	100	6.8 - 7.4	7.1 ± 0.2	7.1	7.2	7.3

Notes:

1. The range, mean, and standard deviation are for detects only.
2. N = number of samples.
3. UCL = upper confidence level.
4. The 95 percent UCL, 75th percentile, and 95th percentile were computed for detected constituents; one-half of the reporting limit was substituted in the calculation of these statistics for non-detected constituents.

Summary of Leachate VOAs in the Control, Retrofit and As-Built cells (mg/L)

Par ame ter	Landfill Unit	N	Percent Detected	Detection Limit	Range (Min-Max)	Mean ± Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
Aci d	As-Built cell A	36	92	1 - 5	1.9 – 1,654	$197.6 \pm$ 387.2	286.7	127.5	1,052
	As-Built cell B	37	97	1	1.1 – 2,580	$274.3 \pm$ 542.9	416.0	167	1,241
	Control cell A	37	57	1	1.6 - 357	$39.47 \pm$ 91.73	42.4	3	111
	Control cell B	36	83	1	1.6 – 1,010	75.3 ± 196.4	113.8	42.3	214.3
	Retrofit cell A	36	53	1	1 – 2,353	140 ± 536.5	184.3	3.6	72.3
	Retrofit cell B	37	51	1	1.2 - 2340	$132.7 \pm$ 534.9	175.0	2.3	57.2
But yric Aci d	As-Built cell A	36	28	1 - 5	7.4 – 1,195	276 ± 389.2	142.9	8.8	521.5
	As-Built cell B	37	30	1 - 5	11 – 1,035	$338.8 \pm$ 418.4	176.2	15	871.6
	Control cell A	37	3	1	33 - 33	33.0	2.9	0.5	0.5
	Control cell B	36	22	1	3.9 - 550	$147.1 \pm$ 237.1	67.6	0.5	181
	Retrofit cell A	36	6	1	20 – 2,134	1077 ± 1495	160.4	0.5	5.4
	Retrofit cell B	37	5	1 - 5	4.6 - 704	$354.3 \pm$ 494.6	51.8	0.5	2.92
For mic Aci d	As-Built cell A	36	17	1 - 20	1.5 - 11	4.6 ± 3.8	2.2	0.5	7.5
	As-Built cell B	37	14	1 - 10	1.1 - 13	6.1 ± 5.9	2.2	0.5	6.4
	Control cell A	37	14	1	1 - 23	5.8 ± 9.6	2.2	0.5	1.8

Summary of Leachate VOAs in the Control, Retrofit and As-Built cells (mg/L)
(continued)

Parameter	Landfill Unit	N	Percent Detected	Detection Limit	Range (Min-Max)	Mean ± Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
Formic Acid	Control cell B	36	8	1 - 5	1.2 - 24	9.8 ± 13	2.4	0.5	1.9
	Retrofit cell A	36	11	1	1.9 - 20	7.3 ± 8.6	2.2	0.5	3.1
	Retrofit cell B	37	11	1 - 20	1.1 - 6.5	3 ± 2.4	1.5	0.5	3.5
Lactic Acid	As-Built cell A	36	6	1 - 20	1.8 - 2	1.9 ± 0.1	1.4	0.5	2.1
	As-Built cell B	37	8	1 - 10	3.7 - 34	18.6 ± 15.2	3.8	0.5	7.6
	Control cell A	37	3	1	1.4 - 1.4	1.4	0.6	0.5	0.5
	Control cell B	36	3	1 - 5	1.4 - 1.4	1.4	0.7	0.5	0.7
	Retrofit cell A	36	6	1	10 - 22	16 ± 8.5	2.5	0.5	2.9
	Retrofit cell B	37	5	1	3.4 - 52	27.7 ± 34.4	4.3	0.5	1.1
Propionic Acid	As-Built cell A	36	56	1 - 5	2.4 - 1,664	267.1 ± 448.5	249.1	23.5	856.8
	As-Built cell B	37	62	1 - 5	1.7 - 1,984	332.5 ± 578.6	340.4	81	1,505
	Control cell A	37	24	1	1.4 - 365	69.67 ± 118.4	34.9	0.5	84.8
	Control cell B	36	50	1	1.2 - 395	50.04 ± 105.6	47.2	11.8	103.8
	Retrofit cell A	36	25	1	1.6 - 3,149	357.7 ± 1,047	237.5	0.8	16.8
	Retrofit cell B	37	14	1 - 5	1.5 - 2,778	564.6 ± 1,237	203.5	0.5	18
Pyruvic Acid	As-Built cell A	36	0	4 - 80	NA	NA	9.0	NA	NA
	As-Built cell B	37	0	4 - 80	NA	NA	9.9	NA	NA
	Control cell A	37	0	4 - 80	NA	NA	9.1	NA	NA
	Control cell B	36	0	4 - 80	NA	NA	9.2	NA	NA
	Retrofit cell A	36	0	4 - 160	NA	NA	10.0	NA	NA
	Retrofit cell B	37	0	4 - 80	NA	NA	7.6	NA	NA

Notes:

1. The range, mean, and standard deviation are for detects only.
2. N = number of samples.
3. UCL = upper confidence level.
4. The 95 percent UCL, 75th percentile, and 95th percentile were computed for detected constituents; one-half of the reporting limit was substituted in the calculation of these statistics for non-detected constituents.

Summary of Leachate TOC in the Control, Retrofit and As-Built cells (mg/L)

Landfill Unit	N	Percentage Detection	Range (Min-Max)	Mean ± Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
As-Built cell A	21	100	848 – 1,710	$1,223 \pm 201.8$	1,294	1,340	1,570
As-Built cell B	21	100	81.3 – 1,600	$1,068 \pm 388$	1,218	1,385	1,545
Control cell A	21	100	36.9 – 1,080	385.2 ± 357.6	515.3	686	963
Control cell B	21	100	348 – 1,690	665.8 ± 280.6	775	713	997
Retrofit cell A	19	100	157 - 679	353.9 ± 165.5	416.3	449	642.1
Retrofit cell B	21	100	73.9 – 1,260	351 ± 247.1	443	440	556

Notes:

1. The range, mean, and standard deviation are for detects only.
2. N = number of samples.
3. UCL = upper confidence level.
4. The 95 percent UCL, 75th percentile, and 95th percentile were computed for detected constituents; one-half of the reporting limit was substituted in the calculation of these statistics for non-detected constituents.

Statistical Summary of Leachate BOD and COD in the Control, Retrofit and As-Built cells (mg/L)

Parameter	Landfill Unit	N	Percentage Detection	Detection Limit	Range (Min-Max)	Mean ± Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
BOD	As-Built cell A	37	95	20 - 1800	105 – 15,000	1,291 ± 2,681	2,067	900	4,636
	As-Built cell B	38	95	150 - 300	44.8 – 25,300	1,882 ± 4,756	3,094	820.8	10,400
	Control cell A	43	98	600	14.6 - 542	111.7 ± 116.1	143.2	185.5	298.8
	Control cell B	39	100	NA	9.2 - 568	181.2 ± 134.4	217.4	234	454.4
	Retrofit cell A	41	100	NA	18.8 - 231	87.81 ± 52.2	102.1	114	204
	Retrofit cell B	43	100	NA	13.4 – 1,290	107.3 ± 206.1	163.3	86.9	390.6
COD	As-Built cell A	39	100	NA	689 – 30,900	4,635 ± 4,986	6,014	4,485	10,170
	As-Built cell B	39	100	NA	486 – 35,000	5,030 ± 6,212	6,739	4,680	15,370
	Control cell A	42	100	NA	114 – 3,020	1,013 ± 930.3	1,256	1,850	2,752
	Control cell B	41	100	NA	60.3 – 20,000	2,021 ± 3,157	2,870	1,970	4,860
	Retrofit cell A	41	100	NA	189 – 2,740	1,457 ± 583.2	1,605	1,900	2,130
	Retrofit cell B	43	100	NA	358 – 4,820	1,248 ± 826.1	1,474	1,385	3,147
BOD to COD Ratio	As-Built cell A	36	100	NA	0.01 - 1.35	0.25 ± 0.28	0.3334	0.3788	0.7678
	As-Built cell B	36	100	NA	0.03 - 1.04	0.23 ± 0.24	0.2897	0.3174	0.6718
	Control cell A	42	100	NA	0.03 - 0.45	0.12 ± 0.08	0.143	0.1357	0.262
	Control cell B	38	100	NA	0.01 - 0.76	0.16 ± 0.17	0.2099	0.1709	0.586
	Retrofit cell A	39	100	NA	0.02 - 0.21	0.06 ± 0.04	0.07613	0.07125	0.1369
	Retrofit cell B	42	100	NA	0.02 - 0.39	0.07 ± 0.08	0.09757	0.06826	0.2529

Notes:

1. The range, mean, and standard deviation are for detects only.
2. N = number of samples.
3. UCL = upper confidence level.
4. The 95 percent UCL, 75th percentile, and 95th percentile were computed for detected constituents; one-half of the reporting limit was substituted in the calculation of these statistics for non-detected constituents.

Summary of Leachate Nitrogen Content in the Control, Retrofit and As-Built cells (mg/L)

Parameter	Landfill Unit	N	Percent Detected	Detection Limit	Range (Min - Max)	Mean ± Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
Ammonia (As Nitrogen)	As-Built cell A	39	100	NA	464 – 2,720	$1,208 \pm 485.1$	1,330	1,485	1,974
	As-Built cell B	39	100	NA	97.3 – 2,620	$1,234 \pm 511.2$	1,368	1,635	1,884
	Control cell A	42	100	NA	50.9 – 2,260	675.1 ± 656.6	844.4	1,113	1,932
	Control cell B	41	100	NA	48.6 – 1,960	$1,000 \pm 678.8$	1,167	1,650	1,890
	Retrofit cell A	41	100	NA	225 – 19,200	$1,537 \pm 3,257$	2,364	1,070	1,860
	Retrofit cell B	43	100	NA	226 – 7,010	964.9 ± 1039	1,251	1,075	1,536
Nitrite (As Nitrogen)	As-Built cell A	40	83	0.02 - 0.2	0.06 - 0.65	0.3 ± 0.1	0.3	0.3	0.4
	As-Built cell B	40	90	0.02 - 0.2	0.08 - 10.7	0.6 ± 1.8	1.0	0.3	1.0
	Control cell A	43	47	0.02 - 0.1	0.02 - 0.28	0.1 ± 0.1	0.1	0.2	0.2
	Control cell B	42	62	0.02 - 0.1	0.03 - 2	0.2 ± 0.4	0.2	0.1	0.2
	Retrofit cell A	42	45	0.02 - 0.1	0.03 - 1.1	0.2 ± 0.3	0.2	0.1	0.8
	Retrofit cell B	44	16	0.02 - 0.2	0.03 - 0.19	0.1 ± 0.1	0.0	0.0	0.1
Nitrate (As Nitrogen)	As-Built cell A	40	35	0.02 - 0.2	0.05 - 1.7	0.29 ± 0.43	0.20	0.1	0.34
	As-Built cell B	40	40	0.02 - 0.1	0.02 - 26.5	1.84 ± 6.58	2.06	0.09	0.40
	Control cell A	43	26	0.02 - 0.1	0.03 - 0.92	0.21 ± 0.3	0.11	0.04	0.19
	Control cell B	42	48	0.02 - 0.1	0.02 - 0.26	0.07 ± 0.07	0.06	0.05	0.18
	Retrofit cell A	42	38	0.02 - 0.1	0.02 - 0.85	0.1 ± 0.2	0.09	0.05	0.08
	Retrofit cell B	44	30	0.02 - 0.2	0.02 - 0.1	0.04 ± 0.02	0.03	0.03	0.06
TKN	As-Built cell A	13	100	NA	26.5 – 1,340	710.8 ± 416.5	890.3	996	1,208
	As-Built cell B	13	92	100	9.4 – 1,990	778.1 ± 590.1	986.9	967	1,732
	Control cell A	16	100	NA	91.9 – 1,590	462.6 ± 462.9	671.6	858	1,298
	Control cell B	16	100	NA	6.6 – 1,660	666.1 ± 638.1	915.1	1,325	1,540
	Retrofit cell A	16	100	NA	189 – 1,160	672.9 ± 329	808.3	940	1,138
	Retrofit cell B	17	100	NA	89.2 – 1,040	549.1 ± 296.4	662.6	605	1,024

Summary of Leachate Metal Content in the Control, Retrofit and As-Built cells (mg/L)

Parameter	Landfill Unit	N	Percentage Detection	Detection Limit	Range (Min-Max)	Mean ± Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
Total Aluminum	As-Built cell A	8	100	NA	0.32 - 3.4	0.98 ± 1.01	1.67	0.85	2.60
	As-Built cell B	8	100	NA	0.4 - 1.2	0.67 ± 0.28	0.83	0.75	1.12
	Control cell A	8	50	0.2	0.2 - 0.53	0.39 ± 0.14	0.35	0.41	0.49
	Control cell B	8	63	0.2	0.31 - 1.7	0.95 ± 0.5	0.96	0.92	1.45
	Retrofit cell A	7	14	0.2	0.27 - 0.27	0.27 ± NA	0.17	0.10	0.22
	Retrofit cell B	8	13	0.2	0.37 - 0.37	0.37 ± NA	0.20	0.10	0.28
Total Arsenic	As-Built cell A	13	100	NA	0.05 - 0.13	0.08 ± 0.03	0.09	0.10	0.12
	As-Built cell B	13	100	NA	0.03 - 0.09	0.04 ± 0.02	0.05	0.05	0.07
	Control cell A	16	56	0.02	0.01 - 0.09	0.04 ± 0.02	0.04	0.03	0.06
	Control cell B	16	63	0.02	0.01 - 0.1	0.03 ± 0.03	0.03	0.02	0.07
	Retrofit cell A	16	100	NA	0.02 - 0.27	0.13 ± 0.08	0.16	0.17	0.26
	Retrofit cell B	17	100	NA	0.01 - 0.16	0.08 ± 0.05	0.10	0.13	0.15
Total Barium	As-Built cell A	13	100	NA	0.24 - 1.2	0.5 ± 0.24	0.61	0.54	0.83
	As-Built cell B	13	100	NA	0.21 - 0.73	0.4 ± 0.14	0.47	0.45	0.63

Summary of Leachate Metal Content in the Control, Retrofit and As-Built cells (mg/L) (continued)

Parameter	Landfill Unit	N	Percent Detected	Detection Limit	Range (Min - Max)	Mean ± Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
Total Barium	Control cell A	16	100	NA	0.31 - 1.7	0.65 ± 0.35	0.80	0.77	1.18
	Control cell B	16	100	NA	0.17 - 0.54	0.35 ± 0.14	0.41	0.47	0.53
	Retrofit cell A	16	100	NA	0.33 - 1.8	0.93 ± 0.44	1.09	1.25	1.58
	Retrofit cell B	17	100	NA	0.3 - 0.94	0.65 ± 0.22	0.72	0.88	0.92
Total Cadmium	As-Built cell A	13	62	0.001	0.001 - 0.005	0.002 ± 0.001	1.91E-03	1.30E-03	3.00E-03
	As-Built cell B	13	46	0.001	0.001 - 0.003	0.002	1.69E-03	2.20E-03	2.72E-03
	Control cell A	16	13	0.001	0.001 - 0.001	0.001	6.44E-04	5.00E-04	1.03E-03
	Control cell B	16	0	0.001	NA	NA	NA	NA	NA
	Retrofit cell A	16	6	0.001	0.001 - 0.001	0.001	6.50E-04	5.00E-04	7.00E-04
	Retrofit cell B	17	0	0.001	NA	NA	NA	NA	NA
Total Calcium	As-Built cell A	8	100	NA	41.7 - 172	89.9 ± 46.7	117.2	105.4	160.8
	As-Built cell B	8	100	NA	29 - 412	117 ± 128.7	197.9	130.8	329.1
	Control cell A	8	100	NA	37.8 - 144	70.5 ± 32.5	89.1	74.5	122.6
	Control cell B	8	100	NA	22.9 - 126	61.8 ± 33.1	81.0	75.6	112.5
	Retrofit cell A	7	100	NA	44.4 - 112	90.4 ± 21.6	100.9	99.3	108.4
	Retrofit cell B	8	100	NA	73.9 - 126	89.3 ± 16.8	98.5	94.6	115.2
Total Chromium	As-Built cell A	13	100	NA	0.09 - 0.24	0.16 ± 0.05	0.19	0.21	0.24
	As-Built cell B	13	100	NA	0.06 - 0.34	0.12 ± 0.07	0.16	0.14	0.24
	Control cell A	16	100	NA	0.01 - 0.18	0.05 ± 0.05	0.07	0.07	0.16
	Control cell B	16	81	0.003	0.01 - 0.29	0.06 ± 0.08	0.08	0.06	0.16
	Retrofit cell A	16	100	NA	0.03 - 0.14	0.09 ± 0.03	0.10	0.11	0.13
	Retrofit cell B	17	100	NA	0.02 - 0.1	0.05 ± 0.02	0.05	0.05	0.07
Total Copper	As-Built cell A	8	88	0.01	0.02 - 0.06	0.03 ± 0.01	0.04	0.03	0.05

Summary of Leachate Metal Content in the Control, Retrofit and As-Built cells (mg/L) (continued)

Parameter	Landfill Unit	N	Percent Detected	Detection Limit	Range (Min - Max)	Mean ± Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
Total Copper	As-Built cell B	8	88	0.01	0.01 - 0.05	0.03 ± 0.01	0.03	0.03	0.04
	Control cell A	8	38	0.01	0.02 - 0.03	0.02 ± 0.01	0.02	0.02	0.03
	Control cell B	8	25	0.01	0.01 - 0.08	0.04 ± 0.04	0.03	0.01	0.05
	Retrofit cell A	7	29	0.01 - 0.05	0.02 - 0.02	0.02	0.02	0.02	0.02
	Retrofit cell B	8	25	0.01 - 0.05	0.01 - 0.02	0.02 ± 0.006	0.02	0.02	0.02
Total Iron	As-Built cell A	8	100	NA	2.8 - 21.6	7.7 ± 6	11.6	7.7	17.0
	As-Built cell B	8	100	NA	3 - 38.1	9.6 ± 11.9	17.2	8.1	28.9
	Control cell A	8	100	NA	3.9 - 15.3	7.9 ± 4.6	10.5	9.2	15.1
	Control cell B	8	100	NA	2.9 - 14.4	7.1 ± 4	9.3	9.2	13.0
	Retrofit cell A	7	100	NA	8.9 - 16	12.4 ± 2.8	14.1	14.3	15.8
	Retrofit cell B	8	100	0	8.4 - 28.4	15.8 ± 7.2	20.1	19.0	26.8
Total Lead	As-Built cell A	13	100	NA	0.02 - 0.1	0.04 ± 0.02	0.04	0.04	0.07
	As-Built cell B	13	100	NA	0.01 - 0.05	0.03 ± 0.01	0.03	0.04	0.05
	Control cell A	16	44	0.005	0.01 - 0.02	0.01 ± 0.01	0.01	0.01	0.02
	Control cell B	16	38	0.005	0.01 - 0.06	0.02 ± 0.02	0.01	0.01	0.03
	Retrofit cell A	16	63	0.005	0.01 - 0.02	0.01 ± 0.01	0.01	0.01	0.02
	Retrofit cell B	17	18	0.005	0.01 - 0.02	0.01 ± 0.01	0.01	0.00	0.01
Total Lithium	As-Built cell A	1	100	NA	2 - 2	2.00	NA	2.00	2.00
	As-Built cell B	1	100	NA	1.1 - 1.1	1.10	NA	1.10	1.10
	Control cell A	1	100	NA	0.14 - 0.14	0.14	NA	0.14	0.14
	Control cell B	1	100	NA	1.4 - 1.4	1.40	NA	1.40	1.40
	Retrofit cell A	1	100	NA	0.57 - 0.57	0.57	NA	0.57	0.57
	Retrofit cell B	1	100	NA	0.62 - 0.62	0.62	NA	0.62	0.62

Summary of Leachate Metal Content in the Control, Retrofit and As-Built cells (mg/L) (continued)

Parameter	Landfill Unit	N	Percent Detected	Detection Limit	Range (Min - Max)	Mean ± Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
Total Nickel	As-Built cell A	8	100	NA	0.18 - 0.5	0.33 ± 0.1	0.38	0.38	0.46
	As-Built cell B	8	100	NA	0.22 - 0.68	0.39 ± 0.15	0.47	0.46	0.62
	Control cell A	8	100	NA	0.04 - 0.63	0.27 ± 0.26	0.42	0.51	0.62
	Control cell B	8	100	NA	0.35 - 0.67	0.47 ± 0.11	0.53	0.52	0.63
	Retrofit cell A	7	100	NA	0.12 - 0.36	0.22 ± 0.09	0.27	0.28	0.34
	Retrofit cell B	8	100	NA	0.1 - 0.39	0.23 ± 0.11	0.29	0.30	0.36
Total Zinc	As-Built cell A	8	100	NA	0.16 - 1.4	0.65 ± 0.45	0.89	1.00	1.30
	As-Built cell B	8	100	NA	0.21 - 7.6	1.34 ± 2.55	3.08	0.75	5.29
	Control cell A	8	100	NA	0.03 - 0.58	0.23 ± 0.24	0.35	0.44	0.56
	Control cell B	8	100	NA	0.11 - 0.56	0.22 ± 0.15	0.31	0.22	0.47
	Retrofit cell A	7	100	NA	0.03 - 0.15	0.07 ± 0.04	0.09	0.08	0.13
	Retrofit cell B	8	38	0.02	0.02 - 0.17	0.08 ± 0.08	0.07	0.02	0.12

Notes:

1. The range, mean, and standard deviation are for detects only.
2. N = number of samples.
3. UCL = upper confidence level.
4. The 95 percent UCL, 75th percentile, and 95th percentile were computed for detected constituents; one-half of the reporting limit was substituted in the calculation of these statistics for non-detected constituents.
5. Summary statistics of total iron are presented for the year 2004-2005.

Statistical Summary of Leachate VOCs in the Control, Retrofit and As-Built cells ($\mu\text{g/L}$)

Parameter	Landfill Unit	N	Percentage Detection	Detection Limit	Range (Min-Max)	Mean \pm Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
1,4-Dichlorobenzene	As-Built cell A	26	8	10 - 120	14 - 24	19 ± 7.1	17.13	16.5	26.38
	As-Built cell B	28	7	10 - 210	14 - 19	16.5 ± 3.5	24.52	23.88	38.1
	Control cell A	33	70	10 - 67	10 - 45	21.22 ± 8.8	20.29	23	33.7
	Control cell B	34	44	10 - 230	10 - 36	22.4 ± 7.4	25.91	23.25	44.4
	Retrofit cell A	34	65	10 - 17	12 - 28	18.86 ± 4.1	16.19	19	25.35
	Retrofit cell B	35	69	10 - 59	10 - 37	21.54 ± 7.9	20.1	24	35.6
Acetone	As-Built cell A	13	92	84	73 - 1500	521.3 ± 427.8	688.7	630	1200
	As-Built cell B	14	57	58 - 84	74 - 2900	1243 ± 1288	1227	945	2770
	Control cell A	16	13	34 - 120	77 - 270	173.5 ± 136.5	73.78	40.5	125.3
	Control cell B	17	76	34 - 80	43 - 7900	1618 ± 2450	2100	1200	6300
	Retrofit cell A	17	18	34 - 84	61 - 520	253.7 ± 238.2	119.2	42	248
	Retrofit cell B	17	24	34 - 84	37 - 1800	524.5 ± 854.6	343.1	41	536
Benzene	As-Built cell A	13	8	3.2 - 10	12 - 12	12	5.569	4.4	7.8
	As-Built cell B	14	29	7 - 14	7.1 - 9.3	7.825 ± 1	6.204	7.075	8.195
	Control cell A	16	50	5.7 - 14	4.5 - 12	9.113 ± 3	8	8.675	12
	Control cell B	17	65	1.2 - 28	6.9 - 16	11.24 ± 2.9	10.77	12	16
	Retrofit cell A	17	6	2 - 10	4.3 - 4.3	4.3	3.544	3.55	5
	Retrofit cell B	17	35	3 - 10	5.3 - 8.6	6.4 ± 1.1	5.212	5.9	6.84
Ethylbenzene	As-Built cell A	13	100	NA	31 - 91	46.54 ± 16.1	54.54	51	73
	As-Built cell B	14	100	NA	28 - 100	53.29 ± 18.1	60.86	55.75	79.85
	Control cell A	16	88	6.9	6.4 - 160	60.39 ± 40	70.21	76.5	109
	Control cell B	17	100	NA	13 - 170	94 ± 47.1	112.9	140	162

Statistical Summary of Leachate VOCs in the Control, Retrofit and As-Built cells ($\mu\text{g/L}$)
(continued)

Parameter	Landfill Unit	N	Percentage Detection	Detection Limit	Range (Min-Max)	Mean \pm Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
Ethylbenzene	Retrofit cell A	17	94	8	26 - 94	53.31 ± 20.2	59	64	91.6
	Retrofit cell B	17	94	8	28 - 110	65.56 ± 20.5	70.65	75	97.2
Methyl Ethyl Ketone	As-Built cell A	13	77	68 - 72	180 - 4800	1541 ± 1604	1884	1800	4200
	As-Built cell B	14	57	68 - 72	70 - 10000	3257 ± 4078	3421	1060	8115
	Control cell A	16	13	10 - 140	24 - 720	372 ± 492.1	155.5	29.88	232.5
	Control cell B	17	71	10 - 72	14 - 12000	2340 ± 3908	3135	1200	9600
	Retrofit cell A	17	29	10 - 72	50 - 240	109 ± 78.77	75.06	50	144
	Retrofit cell B	17	18	10 - 72	24 - 760	292.3 ± 406.5	155.8	36	226.4
	As-Built cell A	13	100	NA	26 - 200	101.2 ± 45.6	120.2	130	164
Toluene	As-Built cell B	14	100	NA	20 - 150	91.5 ± 32.4	105.1	113.8	137
	Control cell A	16	38	5 - 18	6.2 - 47	17.45 ± 15.1	14.09	9.5	25.25
	Control cell B	17	88	5 - 8.9	10 - 190	59.8 ± 56.5	76.24	55	166
	Retrofit cell A	17	71	5 - 8.9	6.9 - 39	17.06 ± 10.1	17.33	15	31.8
	Retrofit cell B	17	47	5 - 8.9	10 - 57	27.5 ± 19.2	21.89	19	56.2
	As-Built cell A	13	100	NA	68 - 260	115 ± 48.7	137.9	120	194
Total Xylenes	As-Built cell B	14	100	NA	71 - 280	129.9 ± 54.5	154.5	140	215
	Control cell A	16	94	19	38 - 390	175 ± 101.3	208.2	235	300
	Control cell B	17	100	NA	56 - 500	279.6 ± 129.5	329.2	380	436
	Retrofit cell A	17	100	NA	32 - 270	149 ± 68.1	174.3	200	246
	Retrofit cell B	17	100	NA	100 - 310	191.2 ± 54.9	212.9	220	270

Notes:

1. The range, mean, and standard deviation are for detects only.
2. N = number of samples.
3. UCL = upper confidence level.
4. The 95 percent UCL, 75th percentile, and 95th percentile were computed for detected constituents; one-half of the reporting limit was substituted in the calculation of these statistics for non-detected constituents.

Summary of Leachate SVOCs in the Control, Retrofit and As-Built cells (µg/L)

Parameter	Landfill Unit	N	Percentage Detection	Detection Limit	Range (Min-Max)	Mean ± Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
1,4-Dioxane	As-Built cell A	13	23	12 - 43	25 - 37	31.7 ± 6.1	20.3	21.5	34.6
	As-Built cell B	14	21	20 - 200	19 - 24	21.7 ± 2.5	38.3	24.4	66.5
	Control cell A	17	41	10 - 62	13 - 55	30.9 ± 15.9	23.7	31	44.6
	Control cell B	17	29	10 - 110	36 - 86	50.4 ± 20.5	34.4	42.5	61.2
	Retrofit cell A	17	59	10 - 20	24 - 120	59.9 ± 28.9	51.8	51	94.4
	Retrofit cell B	18	61	10 - 19	12 - 63	37.8 ± 14.3	32.7	39	53.7
Cresol, m-	As-Built cell A	13	77	34 - 92	120 - 1400	547 ± 402.6	613.4	510	1160
	As-Built cell B	14	50	70 - 200	100 - 5300	1981 ± 2243	1892	925	5170
	Control cell A	17	18	10 - 23	1100	745.3 ± 614.3	328.1	11.5	1100
	Control cell B	17	41	10 - 400	57 - 1800	640.7 ± 797.5	505.4	200	1800
	Retrofit cell A	17	24	10 - 42	44 - 420	167.5 ± 171.2	94.65	21	180
	Retrofit cell B	18	22	10 - 41	36 - 1000	505 ± 521.1	233.4	20.5	923.5
Cresol, o-	As-Built cell A	13	77	19 - 35	28 - 160	64.6 ± 42.7	72.1	65	130
	As-Built cell B	14	21	39 - 180	50 - 150	83.7 ± 57.4	59.7	49.6	111
	Control cell A	17	0	10 - 56	NA	NA	NA	NA	NA
	Control cell B	17	12	10 - 200	21 - 24	22.5 ± 2.1	27.4	10.5	60
	Retrofit cell A	17	6	10 - 20	12	12	8	9.5	10.4
	Retrofit cell B	18	6	10 - 50	16 - 16	16	9.6	7.9	17.4
Cresol, p-	As-Built cell A	13	92	34	54 - 1400	501.4 ± 425.4	659	580	1160
	As-Built cell B	14	79	22 - 80	33 - 4400	1147 ± 1658	1692	1098	4335
	Control cell A	17	35	10	10 - 1200	395.7 ± 585.2	281.9	10	1120
	Control cell B	17	53	10 - 100	15 - 1800	520 ± 737.7	528.2	220	1800

**Summary of Leachate SVOCs in the Control, Retrofit and As-Built cells ($\mu\text{g/L}$)
(continued)**

Parameter	Landfill Unit	N	Percentage Detection	Detection Limit	Range (Min-Max)	Mean \pm Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
Cresol, p-	Retrofit cell A	17	24	10 - 17	50 - 420	170 \pm 169.1	86.29	8.5	180
	Retrofit cell B	18	22	10 - 17	38 - 1000	505.8 \pm 520.3	230.4	8.5	923.5
o-Toluidine	As-Built cell A	13	8	14 - 300	58 - 58	58 \pm NA	59.4	60	102
	As-Built cell B	14	14	40 - 340	42 - 66	54 \pm 17	76.5	60	105
	Control cell A	17	12	10 - 110	58 - 1100	579 \pm 736.8	204.1	17	266.4
	Control cell B	17	12	10 - 600	63 - 65	64 \pm 1.4	71.1	31	140
	Retrofit cell A	17	35	10 - 35	26 - 58	42.7 \pm 15.1	29.2	30	58
	Retrofit cell B	18	50	10 - 150	24 - 160	70.9 \pm 45	61.1	62	134.5
Phenol	As-Built cell A	13	54	11 - 47	78 - 670	265.4 \pm 194.7	238.6	240	448
	As-Built cell B	14	36	21 - 100	73 - 310	200.6 \pm 99.5	128.5	115.8	290.5
	Control cell A	17	12	10	58 - 70	64 \pm 8.5	21.29	5	60.4
	Control cell B	17	47	10 - 100	22 - 3000	783.5 \pm 1253	741.4	94	2680
	Retrofit cell A	17	12	10 - 22	22 - 110	66 \pm 62.2	26.2	10	39.6
	Retrofit cell B	18	17	10 - 22	12 - 210	144 \pm 114.3	52.3	10.6	210

Notes:

1. The range, mean, and standard deviation are for detects only.
2. N = number of samples.
3. UCL = upper confidence level.
4. The 95 percent UCL, 75th percentile, and 95th percentile were computed for detected constituents; one-half of the reporting limit was substituted in the calculation of these statistics for non-detected constituents.

Summary of Leachate Phosphorus in the Control, Retrofit and As-Built cells (mg/L)

Parameter	Landfill Unit	N	Percentage Detection	Range (Min-Max)	Mean ± Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
Phosphate, Ortho	As-Built cell A	40	100	0.8-16.5	6.848 ± 4.021	7.919	9.325	13.22
	As-Built cell B	41	100	1.5-18.3	7.083 ± 4.056	8.15	9.2	15.2
	Control cell A	42	100	0.08-5.7	2.029 ± 1.581	2.439	3.225	5.08
	Control cell B	41	100	0.27-16.6	3.672 ± 3.468	4.584	5.2	9.1
	Retrofit cell A	41	100	1-6.1	3.505 ± 1.132	3.803	4.3	5.1
	Retrofit cell B	43	100	0.54-7	2.617 ± 1.457	2.991	3.3	6.31
Phosphorus, Total	As-Built cell A	39	100	0.97-21.6	11.17 ± 5.16	12.57	15.15	18.56
	As-Built cell B	39	100	0.33-25.9	10.51 ± 6.718	12.32	14.8	21.73
	Control cell A	42	100	0.11-8.6	3.086 ± 2.868	3.831	5.825	8.37
Phosphorus, Total	Control cell B	41	100	0.11-17	5.342 ± 4.311	6.476	7.4	13.7
	Retrofit cell A	41	100	0.78-14.6	4.259 ± 2.482	4.912	4.9	7.2
	Retrofit cell B	43	100	1-9.5	3.647	4.141	4.2	7.12

Summary of Leachate Chloride in the Control, Retrofit and As-Built cells (mg/L)

Landfill Unit	N	Percentage Detection	Detection Limit	Range (Min-Max)	Mean ± Standard Deviation	95 Percent UCL	75th Percentile	95th Percentile
As-Built cell A	13	100	NA	482 - 3070	1918.6 ± 899.2	2363	2670	2956
As-Built cell B	13	100	NA	689 - 3560	2056.1 ± 1039.7	2570	2940	3554
Control cell A	16	100	NA	198 - 4820	1428.1 ± 1416.7	2049	1502.5	3942.5
Control cell B	16	100	NA	66.4 - 3920	1703.6 ± 1512.4	2366	3195	3635
Retrofit cell A	16	100	NA	818 - 2320	1609.7 ± 487.9	1823	1970	2267.5
Retrofit cell B	17	94.1	10	619 - 2270	1516.2 ± 422.3	1660	1800	2014